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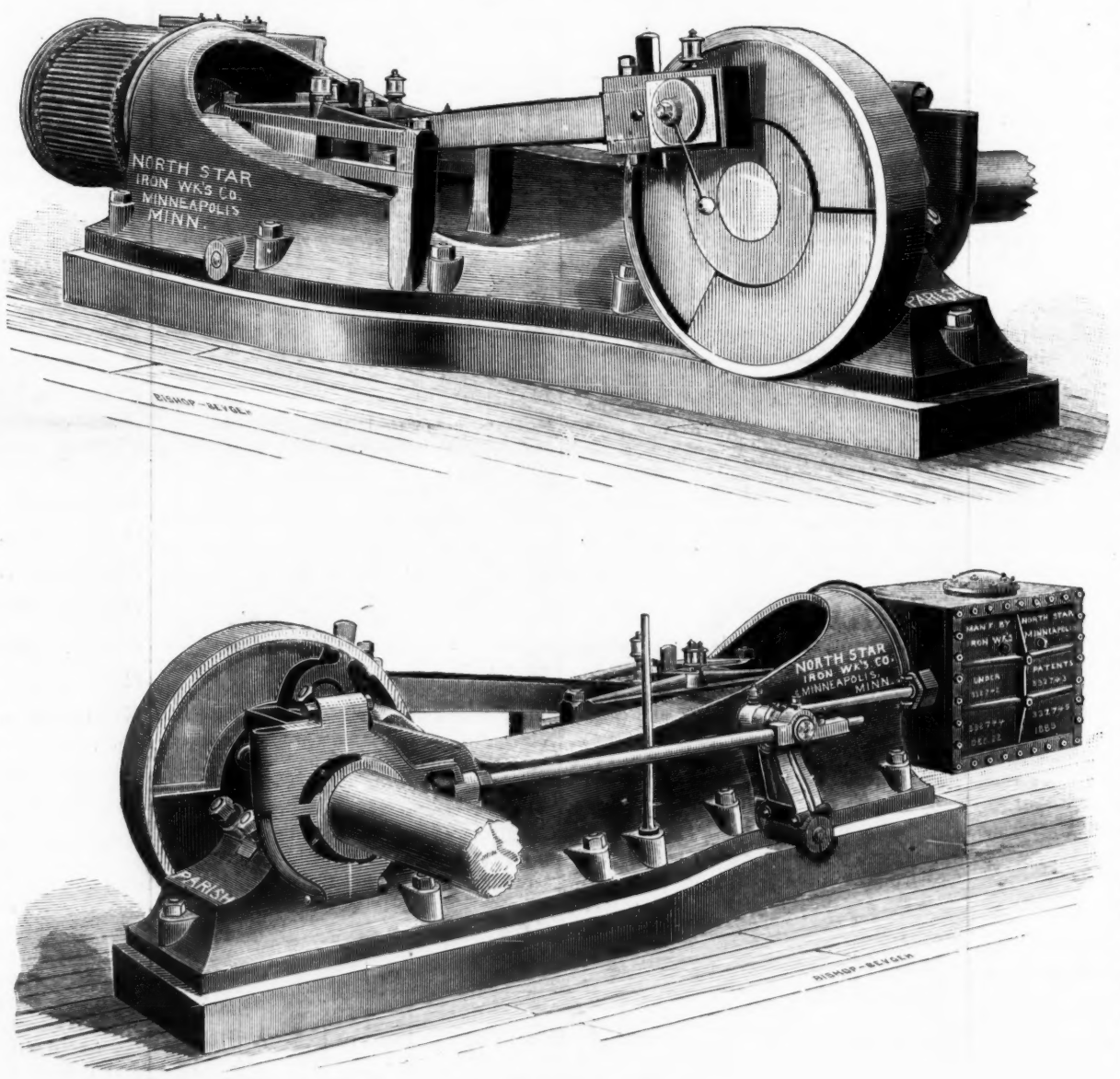
The Parish Engine.

These engines are made by the North Star Iron Works, Minneapolis, Minn. The design is to provide for high piston speed and heavy continuous work. To this end large and well-fitted wearing surfaces are provided throughout. The connecting rod is six times the length of the crank, and the steam and exhaust valves amply large, and arranged to provide good drainage.

All parts are constructed to provide convenient means for adjustment and lubrication. This type of engine is built in sizes from 25 to 1,000 horse-power.



PARISH'S HIGH SPEED ENGINE.

A recent Austrian departure in steamship propulsion, consists of building the hull in shape of two cigar-shaped air-tight cylinders with a web attached to outside of cylinder, forming a continuous screw.

The cylinders are revolved by engines on deck, which is supported upon the ends of both cylinders.

The "freak hunting" mechanic might employ his time and money in a better way than in building impossible machines, and mechanical monstrosities.

Let such men turn their attention to solving every day questions and queries. How would it do to erect two lines of shafting, each 100 feet long. Make one line 1″, the other 2″ in diameter.

Run both lines through a dynamometer pulley and note the speeds at which both shafts will convey power at least cost; also ascertain how fast the 2″ shaft must run to consume the same amount of power used by 1″ shaft at 300, and other speeds, per minute. Certain bearings might be thrown out of line and the power thus consumed, carefully measured.

An accurate statement of the behavior of these shafts, would be of more value than numberless automatic car-couplers and patent friction couplings.

Getting shafting and pulleys into place in a mill or factory is a job which will kill much or little time, according to skill of foreman in charge of the job.

Many times the job of moving machinery may be lightened by using two or more sets of falls. When there is a chance to attach the fall to overhead floor beams, it is easy to swing objects along by raising, lowering and swinging the object along as it hangs suspended. Split engine pulleys are awkward to handle on rolls, but can be easily and quickly put in place by this method.

Abstracts of Topical Discussions and of Papers at the Chicago Meeting of the Mechanical Engineers.

As usual the topical discussions formed a valuable and interesting part of the proceedings of the society. One entire evening and a part of another was given up to these discussions.

The first question discussed was: "Are there any grave objections to cam motions for moving the valves of steam engines; what is a limiting speed for cams?"

Mr. Hemenway had used cams quite extensively for the purpose named. When beginning their use he believed that the speed must be kept down to or below 100 revolutions of engine per minute, but more as an experiment than otherwise he had used them at 240 revolutions without developing any serious objections. The form and construction of cam had much to do with the question of the effect of speed. Another important consideration was the work required of the cam. In his use the work was only that of driving light valves almost absolutely balanced, and which were never moved a distance exceeding three-quarters of an inch. At high speeds if heavy work was required of cams when used to move the valves of steam engines, their action would not be satisfactory. He could not say what was a limiting speed, as he was satisfied he could have used them at higher speed than that named, viz., 240 revolutions.

Mr. Babcock had used cams for driving the valves of steam engines, but not at very high speeds. Seventy-five revolutions per minute was the fastest speed named.

To the question, "What is the maximum safe load for steel tires on steel rails; can this be expressed in terms of the crushing strength of the tire and rail, and per inch of width for different diameters of tire?" Mr. Towne replied by adducing the experiments of Mr. Chanute on the Erie Railroad, illustrating by a diagram showing remarkably small contact between tire and rail.

Mr. Sinclair said the small area of contact showed that the tire was coned. The deductions made from Mr. Chanute's experiments had been productive of much injury. He fixed the safe load at so low a limit that carrying his theory into practice resulted in slipping of wheels, which was much more injurious to rails than load. Mr. Chanute fixed the limit of load on a wheel at 12,000 lbs. This was, in many instances, greatly exceeded without injurious effect. There is undoubtedly a limit somewhere, but it has not yet been reached.

Mr. Smith had subjected rollers of cast steel three inches diameter and four inches face to a weight of 15,000 lbs. without injury. The question failed in bringing out any satisfactory formula covering the points involved.

"What is the present status in Chicago of the question of smoke-preventing furnaces under steam boilers," was referred more particularly to Chicago members. One speaker said no progress could be reported. There had been a multiplicity of inventions brought forward for the purpose of preventing smoke, but in every instance their use increased the fuel consumption to such an extent that it was found cheaper to dispense with them and submit to the payment of a fine every three months for violating the ordinance.

Various plans, such as a brick arch and the old-time dead plate, were mentioned by other speakers as helps in preventing smoke. It was said that the quality of fuel used had an important bearing on the question, hence what might be of service in one city, using a certain kind of fuel, might be absolutely worthless when a different quality of coal was used. The conclusion was rather general that a good fireman was the most efficient smoke preventer in use.

Wandering a little from the discussion proper, one speaker made an interesting point on economy in burning bituminous coal. It was that he found that by burning 25 pounds per hour per square foot of grate area the economy was 40 per cent. better than when burning only 12 pounds.

"Would the use of an annular jet in an ejector induce a greater current of the fluid to be moved than if a solid jet was used?" was one of the queries.

Mr. Walker and Mr. Smith thought that as the friction of an annular jet would be greater than that of a solid one, the efficiency would be correspondingly greater.

Mr. Durfee had used the annular jet with good results.

Mr. Babcock considered the kind of fluid operating and operated upon would materially influence the results. With air he thought the annular jet would be the more effective. He had found an annular ring the most effective for a blower, as for a steamboat. With steam and water it would be different; with these there would probably be no difference as between an annular and a

solid jet. By an annular ring he referred to one open through the center as well as free at the sides.

Mr. Smith called attention to the fact that M. Giffard, who discovered the injector, in describing its operation, said that the annular jet was the exact equivalent of the solid one.

Mr. Babcock said that although not exactly in line with the question, there was one point in connection with the use of a jet in a smoke stack that was not, perhaps, known to all. That was that, if instead of putting the jet in near the bottom it was carried well up towards the top the effect was much better. It should be so high that the steam would spread out and fill the stack just at the top.

This question was then discussed: Moulds for printing-press moulds; what are the best-known conditions covering the moulding, mixing, melting and casting of iron for the successful production of such tubes.

In explanation, Mr. Hawkins said the reference was to tubes of cast iron, with holes averaging about three inches diameter, to be bored smooth and absolutely without blow-holes on the inside. They left about one-half inch of metal outside of bore. The length of tubes was usually from six to seven feet. In reply to queries, he said they used dry sand cores, and tried them made in a great variety of ways. Sometimes these tubes were made in quantities of several hundred, with a loss of not more than 10 to 20 per cent; then, with apparently the same material and practice, not more than the same percentage would be good. They were cast on end in dry sand.

Mr. West inquired how they were gated.

Mr. Hawkins said they had tried one and two gates, but had the best success with one.

Mr. West would not attempt to say how they should be made, but would offer a suggestion or two. He said that iron was absolutely clean, so any dirt present that defaced the casting must come from the mould. The use of only one gate was objectionable; would recommend pouring from both top and bottom, with small gates at the top. One trouble in making such castings was in the use of thick blacking.

Mr. Walker argued the probability of the trouble arising from the presence of sulphur in the iron.

Mr. West thought sulphur a weak excuse of a poor moulder. In his experience, he had never found occasion to place the blame for poor castings upon sulphur.

Mr. Babcock thought the trouble was in the moulder. He had found in duplicate castings, of which their firm required a great many, that but few moulders would make them as good as required. They would lose substantially all they made. Their only success was in teaching green hands how to make that particular piece. They submitted to any amount of loss of pieces for two or three weeks, at the end of which time the workman would have learned to make that particular piece right, and would afterward seldom lose a casting. In the instance of the tubes, attention enough had not been paid to the moulding.

The explanation was made that these tubes—good and bad—were made by the same moulder.

Mr. Kent thought there might be some difference in the cupola practice.

EXPERIMENTS ON THE TRANSMISSION OF POWER BY BELTING.

The above was the title of a paper presented by Wilfred Lewis. The author says: "These experiments were undertaken with a view to determine, under actual working condition, the internal resistances to be overcome, the percentage of slip, and the coefficient of friction on belt surface."

The paper detailed very elaborate tests, from which the following conclusions were drawn:

1. That the coefficient of friction may vary under practical working conditions from 25 per cent. to 100 per cent.

2. That its value depends upon the nature and condition of the leather, the velocity of sliding, temperature and pressure.

3. That an excessive amount of slip has a tendency to become greater, until the belt finally leaves the pulley.

4. That a belt will seldom remain upon a pulley when the slip exceeds 20 per cent.

5. That excessive slipping dries out the leather and leads toward the condition of minimum adhesion.

6. That raw hide has much greater adhesion than tanned leather, giving a coefficient of 100 per cent. at the moderate slip of 5 ft. per minute.

7. That a velocity of sliding equal to .01 of the belt speed is not excessive.

8. That the coefficients in general use are rather below the average results obtained.

9. That when suddenly forced to slip the coefficient of friction becomes momentarily very high, but that it gradually decreases as the slip continues.

10. That the sum of tensions is not constant, but increases with the load to the maximum extent of about 33 per cent. with vertical belts.

11. That, with horizontal belts, the sum of the tensions may increase indefinitely as far as the breaking strength of the belt.

12. That the economy of belt transmission depends principally upon journal friction and slip.

13. That it is important on this account to make the belt speed as high as possible within the limits of 5,000 or 6,000 ft. per minute.

14. That quarter-twist belts should be avoided.

That it is preferable in all cases, from considerations of economy in wear on belt and power consumed, to use an intermediate guide pulley, so placed that the belt may be run in either direction.

16. That the introduction of guide and carrying pulleys adds to the internal resistances an amount proportional to the friction of their journals.

17. That there is still need of more light on the subject.

In the discussion of this paper Mr. Hawkins said that at high belt speeds centrifugal action became an important factor, which was not considered by Mr. Lewis. He had known instances where centrifugal effect prevented the use of leather belts, light linen belts being substituted.

Mr. Towne thought that in bending and unbending, in passing the pulleys, considerable power was absorbed.

Mr. Lewis said that in their experiments they had been unable to detect any loss from this cause.

Finding Correct Gears to Cut Screws.

The following tables to find gears to cut screws on any lathe, together with the explanations, have been prepared by Joshua Rose, and are from advanced sheets of his new book entitled "Modern Machine Shop Practice," which will soon be published simultaneously in the United States and England:

It is usual to fasten to the side of the lathe head stock a brass plate, giving a table of threads, and the wheels that will cut them, and obviously such tables vary according to the pitch of the lead screw, but a universal table may be constructed, such as the following (prepared by the author) that will serve for any lathe.

At the top of the table is the number of teeth in wheels, advancing by four from 12 to 80 teeth, but it may be carried as much beyond 80 as desired. On the left-hand of the table is a column of the same wheels. At the bottom of the table are pitches of lead screw from 3 up to 20 threads per inch. Over each lead screw pitch are thread pitches, thus on lead screw pitch 4 we have 20, 19, 18, and so on.

The use of the table is a follows:

Find the pitch of the lead screw, and at the head of that column is the number of teeth for the lathe stud or mandrel. Then find in that column the number of threads to be cut, and on the same line, but at the left hand will be found the number of teeth for the lead screw.

EXAMPLE.—The lead screw has a pitch of 4, and I require to cut 13 threads per inch. At the head of the column is 16, and on a line with the 13 of the column, but on the left is 52, each number being marked by a*; hence the 16 and 52 are the wheels; if we have not those wheels, multiply both by 2 and 32, and 104 will answer. If the pitch of the lead screw is 2 threads per inch, the wheels must advance by 6 teeth, as below.

NUMBERS OF TEETH FOR WHEEL TO GO ON LATHE STUD, LATHE SPINDLE OR MANDREL.

Lead Screw.	12	18	24	30	36	42	48	54	60	66	72	78	86	90	96
12	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
18	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
24	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
30	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
36	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
42	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
48	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
54	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
60	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Pitch of Lead Screw	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

This table may be used for compound lathes by simply dividing the pitch of the lead screw by the ratio of the compounded pair of wheels. For example, for the wheels to cut 8 threads per inch, the pitch of lead screw being 4 and the compounded gears 2 to 1, as the ratio of the compounded pair is 2 to 1, we divide the pitch of lead screw by 2 which gives us 2, and we thus find the wheels in the column of pitch of lead screw 2, getting 12 and 48 as the required wheels, the 12 going top because it is at the top of the table, and the 48 on the lead screw because it is at the left-hand end of the table, and the lead screw gear is at the left hand end of the lathe.

NUMBERS OF TEETH FOR WHEEL TO GO ON LATHE SPINDLE, LATHE STUD OR MANDREL.

Lead Screw.	12	*16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80
12	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
16	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
20	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
24	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
28	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
32	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
36	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
40	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
44	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
48	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
*52	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
56	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
60	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
64	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
68	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
72	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
76	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
80	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
	Lead Screw Pitch 3.	Lead Screw Pitch 4.	Lead Screw Pitch 5.	Lead Screw Pitch 6.	Lead Screw Pitch 7.	Lead Screw Pitch 8.	Lead Screw Pitch 9.	Lead Screw Pitch 10.	Lead Screw Pitch 11.	Lead Screw Pitch 12.	Lead Screw Pitch 13.	Lead Screw Pitch 14.	Lead Screw Pitch 15.	Lead Screw Pitch 16.	Lead Screw Pitch 17.	Lead Screw Pitch 18.	Lead Screw Pitch 19.	Lead Screw Pitch 20.

The table may be made for half threads as well as whole ones by simply advancing the left-hand column by two teeth, instead of by four, thus:

Teeth for Wheel on Lead Screw.	Teeth for Wheel on Stud.								
	12	16	20	24	28	32	36	40	44
12	3	3	3	3	3	3	3	3	3
14	3½	3½	3½	3½	3½	3½	3½	3½	3½
16	4	4	4	4	4	4	4	4	4
18	4½	4½	4½	4½	4½	4½	4½	4½	4½
20	5	5	5	5	5	5	5	5	5
22	5½	5½	5½	5½	5½	5½	5½	5½	5½
24	6	6	6	6	6	6	6	6	6
26	6½	6½	6½	6½	6½	6½	6½	6½	6½
28	7	7	7	7	7	7	7	7	7
30	7½	7½	7½	7½	7½	7½	7½	7½	7½
32	8	8	8	8	8	8	8	8	8
34	8½	8½	8½	8½	8½	8½	8½	8½	8½
36	9	9	9	9	9	9	9	9	9
38	9½	9½	9½	9½	9½	9½	9½	9½	9½
40	10	10	10	10	10	10	10	10	10
42	10½	10½	10½	10½	10½	10½	10½	10½	10½
Pitch of Lead Screw.	3	4	5	6	7	8	9	10	11

For quarter threads we advance the left-hand column by one tooth, or for thirds of threads by three teeth, and so on.

If we require to find what wheels to provide for a lathe, we take the pitch of the lead screw for the numerator, and the pitch required for the denominator, and multiply them first by 2, then by 3, then by 4, and so on, continuing until the numerator or denominator is as large at it can be to give the required proportion of teeth, and not exceed the greatest number that the largest wheel can contain.

For example: A lathe has single gear, and its lead screw pitch is 8 per inch, what wheels will cut 17, 16, 15, 14 or 13 threads per inch?

			Wheels.		
Pitch of lead screw	8	× 2	16	24	32
Pitch required	18		36	54	72
Pitch of lead screw	8	"	16	24	32
Pitch required	17		34	51	68
Pitch of lead screw	8	"	16	24	32
Pitch required	16		32	48	64
Pitch of lead screw	8	"	16	24	32
Pitch required	15		30	45	60
Pitch of lead screw	8	"	16	24	32
Pitch required	14		28	42	56
Pitch of lead screw	8	"	16	24	32	40
Pitch required	13		26	39	52	65

If we suppose that the greatest number of teeth permissible in one wheel is not to exceed 100, then in this table we have all the combinations of wheels that can be used to cut the given pitches.

Friction Heating.

It is stated that a $500 000 stock company has been organized in Boston to manufacture and introduce an invention of Webster Willis, of the Boston Institute of Technology. The name of the device is a "Friction Heater." It is claimed to have been successfully experimented with in the Hookert Mills, Hookert, N. H., and that an outlay of two horse-power expended in running a chilled iron plate and cylinder will heat, by means of water, a room containing 60,000 cubic feet of air.

The Amalgamated Association of Iron and Steel Workers propose to establish a rolling mill mainly for the purpose of determining the cost of making iron and steel. The chief difficulty experienced every June in agreeing upon a scale of wages for the ensuing year is the difference in views between manufacturers and workmen about the real cost of production. Of course manufacturers will not show their books and workmen think they exaggerate the cost. The experiment of running a mill of their own will give the workmen more insight into the incidental and

accidental expenses of the business than any observation of the conduct of business on the part of their employers. The plan is a good one, and we hope it will be carried out.

Special Shop Tools.

The AMERICAN MACHINIST of June 14th, 1884, illustrated the Williams Brothers' check punch, a device for preventing checks from being "raised."

These punches are manufactured by the Brady Manufacturing Company, Brooklyn, N. Y. In making these punches a great number of jigs are used, which may be applied to great advantage in many other kinds of work.

This company believes in employing first-class men in getting ready to make a lot of machines, and have jigs and templets so made that a boy can do the work without the possibility of a mistake or of poor work.

The accompanying cut shows the back side of one of the jigs, all drilling being done from the other side.

The hub *a* is so located that it can be put through some hole in the casting. The thumb-screw *d* is put on, holding the casting in place. By turning the thumb-screw *e*, the slide *p* is given end motion and the casting is brought to bear against the clips *f* and *g*.

To remove the casting, slack *e* and remove nut *d*. It does not matter if the casting is not put in square with the clips *f* and *g*, as the movement of *p* adjusts the casting without further attention from the workman.

The hole *q* is to be drilled through a projecting lug on the casting, and hole *h* is the same, showing that by special construction of the jig, drilling may be done in one, two or even three planes, as well as in one plane only.

In a centrifugal governor made by this company, nearly all work is done with special jigs. If a hole is to be drilled a templet is at hand which can be so placed that it locates the hole without loss of time or possibility of mistake.

For boring to size large castings for making 4″ valves, the mills which are screwed to an arbor, together with a templet jig for guiding the cutter arbor, reduce the cost of finishing the inside of a 60-pound casting to just one cent!

An ingenious method of cutting a roll for forming tin plates was shown by Mr. Brady.

The rolls, about 22″ in diameter, were to be formed up so as to make a tin plate about 1″ deep, as used for ordinary baking purposes.

The rolls were cut exactly like drop dies, except the shape being projected upon the surface of a cylinder, the dies appear distorted.

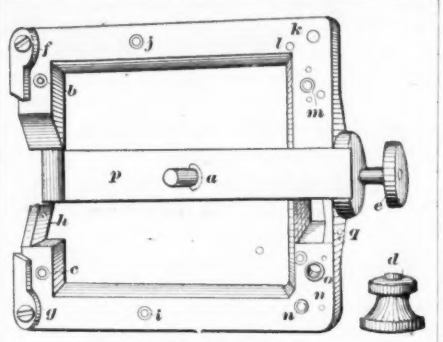
In making, the roll was mounted in the lathe in such a manner that the face of the die coincided with a circle struck on the face plate. This circle being about twice the diameter of the roll, it was necessary to add a counter-balance to the opposite side of the face plate to which the end of roll was chucked.

A templet, made to fit the roll, was cut out and shaped to size of the plate to be made, allowance being made for size of mill with which the die was to be cut out.

A small headstock, carrying the mill on the end of a chuck spindle, was mounted on the carriage, which was built up of parallel iron bars until the cutter spindle was level with lathe centers and the head overhung sufficient to bring end of cutter spindle to circle on headstock, to which the die is to be formed. A lever was put in one of the face plate tee-slots, and projected in the same plane with surface of face plate.

To work the device the mill is brought forward until it cuts to the required depth, when it is moved by means of the lathe feed, until a collar just back of the mill strikes against the templet above described. Now by means of the lathe feed, and by turning the roll with face-plate lever, the milling cutter can be made to follow the templet entirely around its shape. The iron inside the circle thus formed can be cut out in a like manner, leaving a die which is more or less perfect according to the correctness of the templet.

By making the templet of a width equal to



Self-Centering Jig

diameter of collar on mill spindle, both male and female rolls may be cut with the certainty of a fit being secured when the rolls are geared together and revolved.

An ingenious device for holding castings to be roughly turned to size with a heavy feed, when a ½″ arbor must be sufficient to hold the casting true, consists of a universal or a scroll chuck mounted on a sleeve which it fitted loosely, and given motion by means of two lugs which worked loosely in slots formed in another sleeve to which was attached the lathe spindle. When the casting was drilled and driven on an arbor, it was caught by the chuck, which, owing to the sleeves and lugs, was able to follow the casting in all its eccentricity, and to effectually drive it while a heavy cut was being made.

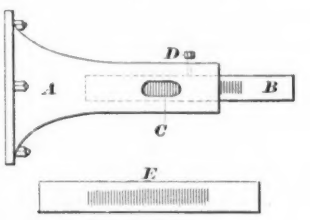
A common bit-stock can be placed on the spindle, and the valve seat reduced to a plane surface in a very short time.

H. R. Tower, Holyoke, Mass., is proprietor and manufacturer. Jenkins Brothers, sole agents, 71 John street, New York.

Lathe Wheel Dog.

At the Boston and Albany Railroad shop, West Albany, N. Y., a lathe is in use which, besides turning car and drive wheels, is fitted with a quartering device and a boring bar for finishing up crank-pin holes.

In turning wheels with this lathe the axle was driven from one end only, and trouble



LATHE DOG.

was experienced when turning the wheel furthest removed from the driving point.

The tool would chatter and dig into the work, which also would spring back, especially when the axle was small.

To obviate the above difficulty, a driver was made to be placed upon the second face-plate, and is shown at *A* in the engraving.

It is a casting similar to that of a petticoat jack-screw, and is bolted to the face-plate by two or more bolts.

A plunger *B* is fitted to slide inside the sleeve. A rack is cut in the sleeve, as shown at *E*.

By putting a bar into the slot *C*, the bar *B* may be drawn out until it touches the car-wheel to be turned.

When in this position the bar is fastened by the set screw *D*.

The bar or plunger *B* is made of the right size to go into the holes usually left in a cored wheel. In a paper wheel the bolt heads and nuts are used to form a bearing for the bar in giving motion to the wheel.

In wheels with neither holes or bolts a hole is drilled through the web, and a bolt inserted, which engages bar *B*.

Upon a trial of this device it helped matters considerably, but did not give satisfaction during all parts of a revolution.

A second driver was made and bolted opposite the first upon the face-plate, and no further difficulty is experienced.

Heavy cuts could be taken without a chatter, and both wheels could be turned at once.

VALVE FILE.

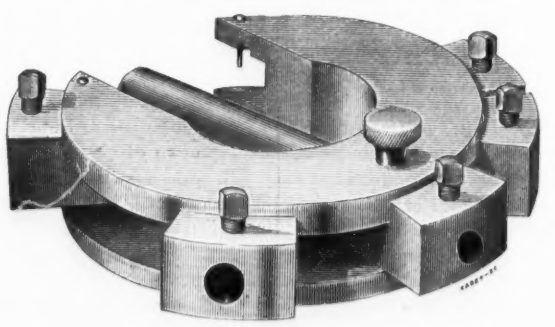
Patent Valve File.

The flat seated valve is one of the best valves in the market while the seat remains flat. When once scored or jammed, the flat seat valve is hard to close tight. Excessive pressure applied to valve stem quickly ruins the packing and aggravates the leak.

The annexed engraving illustrates a device for truing up flat valve seats without removing the valve from its piping.

This device consists of seven reversible mills of different sizes, either of which can be screwed on the spindle as shown in the engraving.

Two double conical bushings, of different sizes, serve to guide the cutter spindle, and are so made that they will fit any valve. They hold themselves in place by engaging the two top threads as shown.



TOOL HEAD.

Common glass cannot be warmed by direct exposure to sunlight. The light and heat both pass through, but artificial light and heat are absorbed by glass.

Rock salt will allow artificial heat to pass, and with a rock salt lens, photographs may be taken (with a specially prepared plate), in the dark, of a heated object.

For instance, a photograph could be made of a black hot casting, or stove, in a dark room.

A solicitor of patents, whether his office is in Washington or elsewhere, has no special privilege to obtain a weekly list of patents granted before the list is given to the "common people." Some of them, however, try to convey the impression to newspaper publishers that they are peculiarly favored by the Patent Office, and we frequently receive an offer from some Washington patent agent to furnish us a weekly list of new patents provided we will publish the same with the announcement that it was furnished us by John Smith & Co. (or other firm) who will send a copy of any of the patents by mail at a certain price, which is always two or three times as much as the price asked by the Patent Office. The seductive offers of these enterprising agents have all been wasted upon us as upon the desert air. The *Official Gazette*, of the U. S. Patent Office, is published weekly at $3 a year, and contains not only a list but a brief description of every patent with a cut. It is the source from which all published lists are obtained, and is mailed promptly to any subscriber whether he is a patent agent or not.

It was brought out in the discussion at the mechanical engineers' meeting, at Chicago, that Whitworth instead of casting steel shafts hollow and hammering them on a mandrel, as was formerly done, casts them solid, removes the center by drilling and then hammers on a mandrel. When cast solid the unsound portion, technically termed "pipes," is at the center of the shaft and is removed in drilling; when cast hollow the unsound portion is midway between the outside and inside surfaces, and of course was not removed.

Tool Head for Lathe or Milling Machine.

This attachment is designed for the same use as the ordinary turned head. It can be applied to any lathe or milling machine.

The essential features of the head are a series of tool carriers, which are adapted to be guided in the head, so that either of them may be brought in line with the spindle, and secured in that position.

In the manufacture of these heads the parts are made interchangeable, and tool carriers can be supplied in duplicate; this enables the operator to have any number of tools set, ready for instant use.

The manufacturers are Armstrong & Company, 15 Foster's Wharf, Boston, Mass.

When a worn car wheel tread is examined under the microscope, it is perceived that the surface of the metal comes off in thin flakes or scales.

Examined under high powers the scales are found to resemble portions of a brick wall, the fractures being not in the particles of iron, but in the material which unites the particles in a manner similar to which mortar unites the bricks of a wall.

Continuous jarring breaks this cement or uniting material, thus allowing iron so treated to fall in pieces.

Knut Gustaf Axel Almquist has been admitted to citizenship at Grand Rapids. His name has a mechanical sound.

Smoke Stacks.

BY ROBERT E. MASTERS.

Reading several articles under the above heading calls to mind an incident in relation to the draft of smoke stacks, for which I have never been able to obtain any satisfactory explanation, and I wish to say here at the outset that I will not attempt to express an opinion, as I am not well enough posted on the subject, but will present the facts and figures for discussion by those who are well up on the draft of smoke stacks.

A manufacturing establishment had in their boiler house ten boilers, placed as shown by the rings *A A* in the cut; back of the boilers the smoke stack *B* was 42′ 6″ high from the ground, and 30″ diameter, with a 12″x24″ opening into the stack at *C*.

Additions having been made to the works, and more machinery and engines put in operation, the firm concluded for the number and size of their boilers that they were not obtaining steam fast enough to give the power they wanted, so they went to work to improve the draft. They put up two stacks, 58′ 6″ high, 22″ diameter, one on each side of the old stack, as seen at *D*, *D*, with an opening into each of them *E*, *E*, 8″x16″.

When these stacks were completed the old stack *B* continued to do all the work without any improvement in the draft, not a particle of smoke coming out of either of the side stacks *D*.

A piece of boiler plate was put over the top of the center stack to shut off the draft, when the side stacks immediately commenced to draw, and there was a decided improvement in the production of steam. This was continued until one day the piece of boiler plate was blown off the top of the center stack by a wind storm, and instantly the old condition of things existed again—the side stacks stopped drawing, the smoke all discharging through the center stack.

If the brick-work behind the boilers had been built in an arc from the sides to the center flue, I would have thought I understood the reason for this, but as the current of heat from the furnace fire passed under the boilers, then back through the flues of the first row of boilers into the smoke box in front, then through the flues of the upper row of boilers to the openings into the stacks, and the space between the back of the boilers and the smoke stacks being covered over on a level above the openings into the stacks, I could not understand why the side stacks did not draw any without shutting off the draft of the center stack; nor could the man who erected the stacks explain it.

The opening *C* in the center stack had an area of 288″. Each of the side openings have 128″ area, giving an advantage of 32″ to the center opening over both of the side openings. The center stack had an area (omitting fractions) of 706″, the side stacks 380″ each, giving an advantage of 54″ to the side stacks combined, besides, the side stacks were 16′ higher.

Right after the boiler plate blew off the top of the center stack the center opening *C* was closed up and the stack taken down. From that time the furnace worked to the satisfaction of the firm.

Suburban Locomotives.

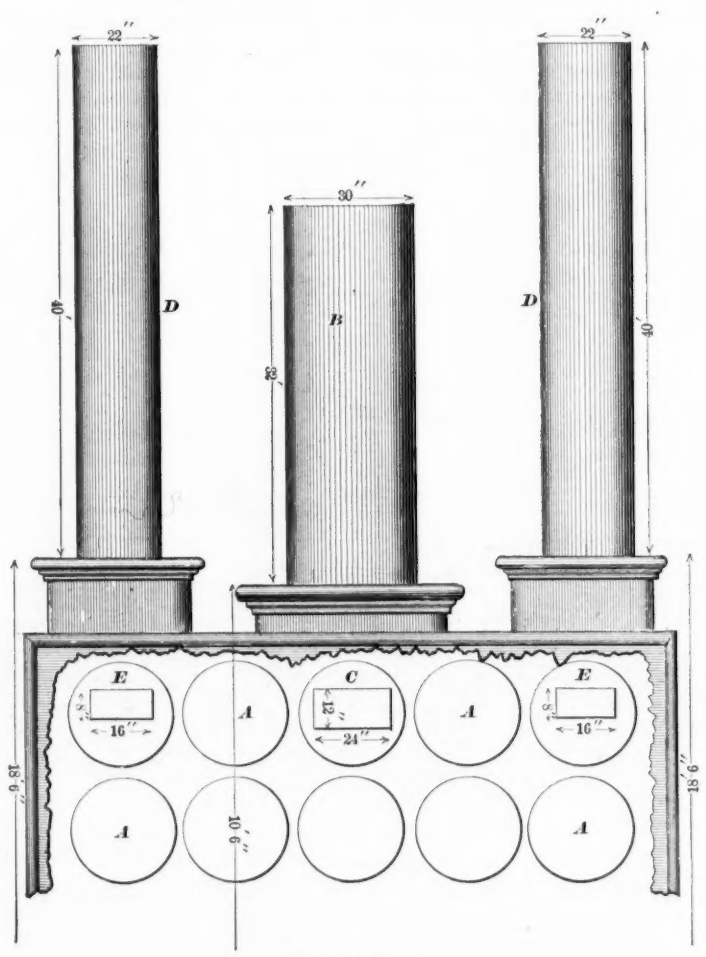
We noticed a few weeks since the suburban double-ender locomotives, building at the Chicago shops of the Illinois Central Railroad. Since then, noting the performance of these locomotives, leads to the belief that they are a remarkably efficient engine for the kind of service required. With the numerous stops to be made, quick stopping and starting are of the greatest importance. On one of their trains running 17 miles, 29 stops are made, and the distance covered in 55 minutes. This it should be remembered is not done with a small locomotive able to draw only three or four cars, but with a 16″x22″ engine, capable of handling heavy trains. The number of stops made in the time noted will give a good idea of how quickly speed is got up to.

The driving wheels of these locomotives are 4′ 8″ diameter. The front truck is a "pony," and of the 57 tons which the engine and tender ready for service weigh, 28 tons are on the drivers. This is as much as is usually got on the drivers of considerably larger locomotives. The valves have ¾-inch lap and 5-inch travel. A good feature about the tank is an elbow pipe projecting from the end, through which water is taken without wetting anything about the tender. The company has thirteen of these locomotives in use, and is building more.

Railroad Shop Notes.

J. K. Corey, master mechanic of the Delaware and Hudson Canal Company's repair shops at Green Island, N. Y., keeps in repair that part of 180 locomotives which are used upon his section of the road, the other repair shops being located at Oneonta, N. Y., and Carbondale, Pa.

The extended smoke-box is not used upon this division of the road. A trial with one locomotive gave such poor results by scattering fire and sparks that the extended front and straight stack were abandoned for the old-style stack with a screen on top.



SMOKE STACKS.

In addition to the usual hydrostatic car wheel press, a hydrostatic lifter is used in this shop for raising the wheels and axles from floor to position in the press.

The device is placed upon top connecting bar of the press, and consists of a cylinder and plunger, which are worked by pressure from the water main.

Detachable hooks are used for connecting lifter and wheels to be raised.

In putting on wheels, the wheel is first raised by the lifter, and the hook put upon a holder for that purpose; then the lifter is detached, and pushed along on connecting bar until it is in position to raise the axle.

It was suggested by the man in charge of this wheel press that the lifting be entirely dispensed with by mounting the wheel press on screw gearing similar to a drop-table.

In this case the wheels could remain upon the floor; the press being raised or lowered to the right height. This would require no change to be made as long as one size of wheels were being put on or off.

In fitting wheels to axles, .004″ is allowed on a 4″ axle, and about double that amount on a 4½″ axle.

In getting the size of wheel bore, a pair of common inside calipers are used, and adjusted to the hole to be fitted. Then a piece of paper is laid over one leg of the calipers, and held by thumb and finger of left hand.

The outside calipers are adjusted to distance contained by the inside tool, plus thickness of paper.

The piece of paper is chosen by micrometer tests, and forms a neat and handy method of making the necessary allowance.

Every wheel requires to be calipered individually, and a fit made for each separate wheel, as the car wheel boring machine in use at this shop does not duplicate the size of holes bored by it.

A handy gauge is in use in this shop for testing the distance between wheels when pressing them on to the axle. It is a ½″ steel rod, pointed at one end, and fitted at the other end with a cap about 7″ long. This cap is drilled to receive the rod, which extends into it about 3″. A spiral spring is placed between end of rod and bottom of hole in cap.

A set screw in rod works in a slotted hole in cap, and prevents rod and cap from being thrown apart by the spring.

The slotted hole allows ¼″ play of the rod endwise. A mark is made on the rod, which coincides with edge of the cap when screw is in center of slotted hole.

When the device is in above position, the combined length of the rod and cap form the exact distance which should occur between insides of wheel flanges, and the ⅛″ play either side of this mark forms the limit of variation allowed.

If the rod will not go between flanges, the wheels are too close together. If the rod will not touch, the wheels are too far apart.

The spring is made sufficiently strong to sustain the weight of the rod when in position between two wheels the right distance apart.

All wheels must go on with a pressure above 25 tons and below 50 tons, which is the extreme maximum limit, except for locomotive drivers.

The Boston and Albany Railroad run some powerful locomotives, and take precautions to prevent accidents which should be taken by every owner of a locomotive in the world.

A number of engines on this road have 18″x26″ cylinders and carry 160 pounds of steam.

To withstand this pressure the boiler must be of the best material, receive the best workmanship, and be subject to unrelaxed and searching inspection.

If but one stay bolt is found broken, the locomotive is condemned and sent to the shop until repairs are made.

To detect broken stay bolts is a problem which does not always get solved. The hammer test does not always detect them, even when the boiler is under pressure, or even under hot pressure.

Workmen are generally to be found who say they can positively detect all broken stay bolts by the hammer, but in the Boston and Albany shops, at East Albany, N. Y., numerous tests have been made by T. B. Purvis, master mechanic.

A number of broken bolts were privately located in a boiler under repair, and the man who "could always tell" was instructed to test every bolt and chalk the broken ones.

The above tests, extended over a number of trials of many men, demonstrated that it was impossible always to detect broken stay bolts.

The method has been adopted of drilling every stay bolt to a depth of ⅞″ with a ⅛″ drill.

A couple of posts are rigged up beside the fire-box, an adjustable cross bar placed against the posts and used to give a bearing to the drill stock.

The drill stock is of common breast pattern, rigged with a shoulder to bear against the cross bar above mentioned.

A flexible shaft is geared to the drill in place of the hand gear usually used; power is taken from any convenient shaft by a round belt and weighted pulleys.

But a few minutes are consumed in drilling each hole, which is first started with a center punch in the middle of each rivet head.

If one of these drilled stay bolts should break, there would be no trouble in detecting the fact, as a ⅛″ jet of steam and water at 160 lbs. pressure, needs but little help in making itself known.

The water used on some divisions of this road, is very bad, and scales badly. When tubes are removed, a big hole has to be made in order to remove them.

A machine is used for "pricking" the scale off the tubes after they are removed from the boiler. The machine consists of three rollers, which are spirally grooved in two directions, leaving the surface of the roll composed of small, diamond-shaped faces. Two rolls are mounted close together, and the tube laid upon and between them. The roll is pressed down on top of the tube. When the machine is started, the scale is rapidly cracked off. The tube is pushed through the rolls and comes out very free from scale.

Tubes are welded in this shop by means of a hand-spring hammer, which is worked by a crank. The tube is slipped on to a mandrel, which is fixed under the hammer, and a few turns of the crank completes the operation of welding half a dozen tubes.

A drop table is used for changing locomotive drivers, and is operated by screw-gearing. The transfer table is in the shop, and is worked by a windlass overhead.

Steam is used for heating the shops during cold weather. A separate boiler is used for this purpose, and is set in the machine shop.

This boiler is of the locomotive type, and the radiation, which is considerable, is utilized in warming the shop. On many mild winter days, the radiated heat is sufficient to warm the machine shop without using the circulation pipes.

A member of the Theatrical Mechanical Association, being interviewed by *Wild Fire*, says: "The theatrical mechanic is just as important as the leading actor or the leader of the orchestra. He must understand his part well, or there will be no play. Just picture to yourself a play going on with no scenic artist; no man at the gas table; no first or no second boss mechanic; no property man (which is all important). Their parts have to be learned, just the same as the leading actor or actress'. In my estimation, the theatrical mechanic is just as essential to a theatre as the gas which lights it up, and should be encouraged, at least once a year, by a grand benefit for the purpose of taking care of our sick and dead, and the widows and orphans that they leave behind them."

Changing Single-Cylinder Non-Condensing to the Compound-Condensing System with Two Cylinders—Advantages of the Triple System When High Pressures are Used.

BY W. H. HOFFMAN.

The editor of the AMERICAN MACHINIST having handed me some data from a river steamer, and at the same time called my attention to a proposition to change the present system, I will herein give my views on this particular case of proposed compounding.

From the memoranda at hand I find that the present motor consists of a pair of horizontal non-condensing engines, each cylinder being 11″ in diameter, the pistons having a stroke of 60″. The steam pressure is 165 lbs. by gauge, or 180 lbs. total (though the diagrams show 182 lbs.); cut-off at half stroke; mean effective pressure, $124\frac{96}{100}$; the revolutions 23 per minute, and the terminal 87 lbs. total. The average indicated horse-power at present is said to be 163.

The officers in charge of the vessel desire to compound the engine in the most economical way by using two cylinders; and as I am asked to suggest proportions, I will endeavor to present sizes for both the double and triple cylinder systems, as the latter is best adapted to an initial total pressure of 180 lbs., and when the point of cut-off is fixed at half stroke or less.

In changing old engines to the compound system it is good practice and economy to save one of the cylinders when the engines are double, and proportion a high or low pressure cylinder to the remaining cylinder. For one of our examples we will do this, and make our comparisons of gain. In this case, then, our high-pressure cylinder is 11″ in diameter, and stroke of piston 60″. As we will fix the cut-off at half-stroke in this cylinder, we shall use just one-half of the quantity of steam that is now used. Having a total pressure of 180 lbs., the relative ratio in areas of high and low-pressure cylinders must be about 1 to $5\frac{3}{4}$, so our low-pressure cylinder must not be less than 27″ in diameter, and we will therefore fix on that diameter.

Our pressure in receiver will be about 17 lbs. by gauge, or 32 lbs. total; and we will fix the cut-off in this cylinder at $\frac{3}{8}$ of the stroke, giving us an average of 20 lbs., while the high-pressure cylinder average will be 103 lbs., after deducting back pressure.

With the high-pressure cylinder we shall develop 69 horse-power, and with the low-pressure cylinder 77 horse-power, or 146 horse-power total, being nearly 90 per cent. of the present power (163) and we have only used one-half of the steam now used.

It will be readily seen that by changing the points of cut-off slightly we will make up the missing 10 per cent. of power. The power will be very nearly equally divided between the two cylinders, bringing the strains on the paddle shaft about central.

The receiver can be mostly formed in the connecting pipe, while the remaining portion will be the jacket of the low-pressure cylinder.

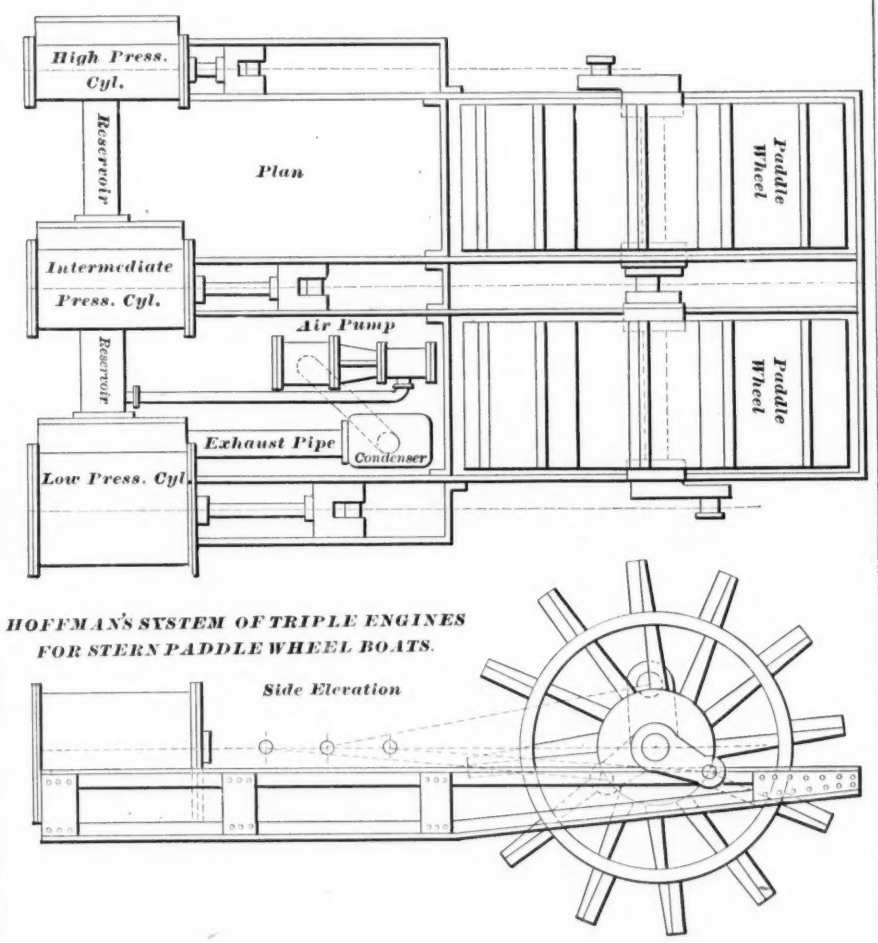
If the high-pressure cylinder should be made new, I would also jacket that on account of the very low piston speed. The consumption of water per horse-power per hour, according to diagrams taken from the present engine, is 34 lbs., but it must be actually 37 lbs., on account of the slow piston speed; so while the compound engine may use 19 lbs. of water at a piston speed of 230 feet per minute, 600 feet would reduce the consumption of water to less than 17 lbs. per horse-power per hour.

We will now give an example. Supposing that we discard both old cylinders; I should then increase the high-pressure cylinder so as to fix the cut-off at $\frac{1}{4}$ of the stroke, and with this develop 82 horse-power; and should also cut-off at $\frac{1}{4}$ or $\frac{1}{3}$ in the low-pressure cylinder, and leave a terminal of 8 lbs. total pressure.

The high-pressure cylinder will now be $14\frac{1}{2}$ inches in diameter; the average pressure, 71 lbs.; and pressure in receiver, 13 lbs., or 27 lbs. total; and an average of 16 lbs. in the low-pressure cylinder. These pressures bring us to the proportional areas between high and low-pressure cylinders of 4 to 1, so the diameter of the low-pressure cylinder will be 29 inches, and this cylinder will also give us 82 horse-power, making a total of 164 horse-power. The object in making two new cylinders in this case would be to allow more margin of cut-off without going beyond $\frac{1}{2}$ stroke, and thus increase the power within the limits of economy.

Now, with either of these two designs for compounding, one-half of the present quantity of steam used is saved, while the revolutions will remain the same; so, of course, the number of revolutions can be largely increased by using the same amount of steam that is now used, as the power will be increased according to the points of cut-off fixed on up to the limit of the boiler capacity. For instance, if we leave one of the present 11-inch cylinders on its bed, we have steam enough to completely fill it at each stroke at the gauge pressure of 165 lbs., and this then becomes our average pressure, instead of the present average, $124\frac{96}{100}$ lbs., and we have doubled the volume of steam to be distributed to the low-pressure cylinder.

As to design, considering the matter of steam economy, if two cylinders are to be used, I would advise the making of two new



HOFFMAN'S SYSTEM OF TRIPLE ENGINES FOR STERN PADDLE WHEEL BOATS.

ones to be placed in the positions of the old ones—one $14\frac{1}{2}$ inches in diameter, and the other 29 inches in diameter—and cutting off from $\frac{1}{4}$ to $\frac{1}{2}$ of the stroke; gauge pressure, 165 lbs. If economy in construction is of importance, I should advise the leaving of one of the present 11-inch cylinders undisturbed, and, in place of the other one on the opposite side of the vessel, put a low-pressure cylinder 27 inches in diameter, and by so doing the cost of the change will be very little compared with the benefits derived.

If the triple system is adopted I should make the diameter of the cylinder as follows: Initial high-pressure cylinder, 10″ in diameter; intermediate pressure cylinder, 16″, and the low-pressure cylinder 27″ in diameter. We should then cut-off at about $\frac{5}{16}$ of the stroke in the high-pressure cylinder, giving us an effective average of 78 lbs. here, and a terminal pressure of 8 lbs. in the low-pressure cylinder, and we shall develop the same power as we did with the $14\frac{1}{2}$″ and 29″ cylinders, double system, cutting-off at $\frac{1}{4}$ of the stroke.

We have thus saved over $14\frac{1}{2}$ per cent. in steam over the two-cylinder compound with $14\frac{1}{2}$″ and 29″ cylinders, and 28 per cent. over the two-cylinder compound with 11″ and 27″, cutting-off at half stroke. If the triple system is used I should preserve one of the 11″ cylinders by bushing it down to 10″, and place the 10″ and 16″ pistons on one piston-rod, if there is room for the cylinders in tandem position, if not I would place the high-pressure and intermediate-pressure cylinders side by side, and connect both piston-rods to one crosshead.

There would be a pass-over valve and pipe between these two cylinders for convenience in starting the engines, as for the first four revolutions the steam would be taken into both of them from the boiler direct.

The water consumption with this triple system will be 15 lbs. per horse-power per hour, while the present consumption is probably from 37 to 40 lbs. The feed-water will have its temperature reduced from 200° to 130°, but this loss will be little compared with the gains elsewhere.

In compounding this engine in any form, I should use an independent direct-acting air-pump, having its own steam cylinder, and exhausting its steam into the receiver of the main engine; this brings the loss in operating an air pump to a minimum.

As the cylinders of a stern-wheel river boat are necessarily some distance apart, it is best, when using the triple system in changing old engines, to place the high-pressure and intermediate pressure together, both operating on the same crank-pin; but when the three cylinders can be brought closer together I should connect the high and low-pressure cylinders to one crank-pin, so as to divide the strains better, the exhaust of the high-pressure first going to the intermediate cylinder, as usual, and thence to the low-pressure. This method evenly divides the strains.

In the triple system, the high pressure cylinder can be placed inside the intermediate cylinder, the intermediate piston being an annular one. By this method all the heat that is radiated through the walls of the high-pressure cylinder goes directly to the intermediate, and is utilized there. This design is excellent for engines up to 500 horse-power. In closing, I will say that with high steam (180 lbs.), the triple system will save from twelve to twenty per cent. in fuel over a two-cylinder compound carrying 100 lbs. pressure. I will also say that in constructing a new light draft steam paddle-wheel vessel, I should certainly carry a steam pressure of 175 lbs., or 190 lbs. total, using the steam in a triple expansion engine.

I should divide the paddlewheel at the center of its length, and make a double or bell-crank at that point on the shaft. One cylinder would transmit its power here, and the other two at each end of the shaft, there being three cranks in all, placed at 120°.

The sketch given below will give a general idea of this plan.

Friends of the Panama Canal scheme say that M. de Lesseps is "moving heaven and earth to complete the job." "M. de Lesseps," observes the San Francisco *Wasp*, "would get on faster if he would move less heaven and more earth."

The pumping engines at the principal pumping station in Chicago have the merit of variety at least. There are two double and two single engines, with valve motion running through the varieties of Stevens, Sickels and Winters. All of the engines are working, except one of the single ones, and are pumping, so it is said, upwards of one hundred million gallons daily. The pumping station, including the tower around the stand pipe, 175 feet in height, is probably the finest structure of the kind in the country, but the engines operate as if they ought to be laid up for general repairs. Only about 20 lbs. of steam is used, and the duty is undoubtedly low.

LETTERS FROM PRACTICAL MEN.

How to Find Relative Economy of Steam Heat and Furnace Heat.

Editor American Machinist:

There appears to be considerable controversy as to the merits of steam and furnace heating. It seems that the matter could be very easily settled by weighing the coal and getting the temperature of flue gas, and finding the heat units lost in chimney. The amount of heat units left, due to the combustion of the coal, must go towards heating the building in either case. It might be necessary to find the weight and composition of flue gas before the experiment was finished. Water has a greater capacity for heat than air, and with the same heating surface exposed to furnace, water will absorb the larger amount of heat, and the temperature in flue will be low, while the air will take up a small amount, and the temperature of flue will be high, and should it come near wood work, or should wood for any reason come in contact with it, a fire is the result. I think Mr. Rowell will find, if he will investigate, that more property has been destroyed by fire started from furnace flues and more lives lost, than from boiler explosions in steam heating.

W. E. CRANE.

Waterbury, Conn.

American and English Freight Rates Compared.

Editor American Machinist:

The extraordinary and unparalleled reduction in the case of moving freight, which has been effected in this country within the last twenty-five years, by the better organization and improved methods of the greatest of common carriers, the railways, equal, as an eminent economist has shown, to the whole reduction of our national debt within the same period, has, strange to say, been accompanied by an ever swelling storm of abuse of these beneficial agencies, which are almost universally treated as grasping and tyrannous monopolies. The following table of the rates received by the railways of Great Britain for carrying 2,000 lbs. avoirdupois of eighteen different classes of merchandise one mile, compared with Trunk Line pool rates for the transportation of the same quantity of similar merchandise a like distance in this country, expressed in mills, is taken, with a slight modication, from London *Engineering*, of April 30, 1886, p. 417, where it appears in the letter of a New York correspondent of that journal. The modification above mentioned consists of reducing the English prices by multiplying them by 100, and dividing them by 112, in order to make them correspond to the 2,000 pounds used in the table of Trunk Line prices, which are throughout expressed by an even number of mills, while the English prices, being reduced from sterling currency at the rate of $4.84 to the pound sterling, require the use of decimals, even when stated for the ton avoirdupois, 2,240 pounds,

and are no less convenient when so modified as to correspond to 2,000 pounds, or the railway "ton" generally used in this country in railway statistics.

RATE PER TON MILE.

Pig Iron.

	Miles.	British Rate.	American Trunk Line Rate.
Barrow to Sheffield	122	12.9	5
" Birmingham	161	14.3	5
Iron Wire, Packed and Unpacked.			
Birmingham to Coventry	19	98.2 & 56.8	7
Birmingham to Manchester	84	43.7 " 26.8	7
Birmingham to Liverpool	97	41.9 " 26.8	7
" London	113	44.9 " 29.0	7
" Hull	132	41.1 " 28.6	7
" Glasgow	286	25.9 " 20.1	7
Hardware.			
Birmingham to Manchester	84	45.5	12
Birmingham to Liverpool	97	43.1	12
" London	113	45.1	12
" Plymouth	222	36.6	12
" Glasgow	286	27.7	12
" Edinb'gh	298	23.7	12
Saws and Tools.			
Sheffield to Hull	53	53.0	12
Cotton Yarns.			
Manchester to Hull	92	42.3	15
" Newcastle	142	35.0	15
Cotton Goods, Export and Home.			
Manchester to Liverpool	31	47.5 & 28.6	15
" Hull	92	41.9	15
Manchester to Birmingham	84	54.5	15
Manchester to Bristol	117	37.8	17
" London	200	22.8 & 39.2	15
" Exeter	266	35.4	15
Woolen, Worsted and Stuff Goods.			
Bradford to Manchester	40	77.7	55
" Birmingham	120	52.0	15
" London	96	43.5	15
" Glasgow	210	42.1	15
Earthenware and China.—Note Trunk Line Rates.			
China, 15, earthenware, 7 mills per ton mile.			
Stoke to Birmingham	45	48.0 & 68.7	15 & 7
" London	150	27.7 & 44.6	15 & 7
General Machinery, Export and Home.			
Leeds to Hull	51	52.9 & 105.8	7
" Newcastle	100	24.8 " 30.6	7
Agricultural Machines (Iron), Export and Home.			
Banbury to London	78	71.4 & 87.5	7
Bedford to "	50	80.7 " 95.0	7
" Liverpool	152	58.8 " 76.8	7
Sugar.			
Liverpool to Manchester	31	76.6	5
Hull to Sheffield	53	47.3	5
London to Northampton	67	34.8	5
" Sheffield	162	20.0	5
Greenock to Newcastle	186	15.2	5
Cotton.			
Liverpool to Manchester	31	50.0	5.4
Wood.			
Liverpool to Manchester	31	63.4	9
Tea.			
Liverpool to Manchester	31	75.4	15
Oranges.			
Liverpool to Manchester	31	63.0	12
Tallow.			
Liverpool to Manchester	31	55.1	6
Bacon and Ham.			
Liverpool to Manchester	31	63.4	6
Grain and Flour.			
Liverpool to Birmingham	97	27.7	5
Bristol to Birmingham	91	17.8	5

Could these "odious monopolies" have deserved from a generous public more censure than they receive if they had raised freight charges up to the British standard, instead of bringing them down to the lowest point ever reached on earth?

There is, doubtless, some foundation for the hue and cry about "watered stock," although much of the difference between the aggregate amount of money paid into the companies for bonds and shares, and the aggregate amount of such securities, represents undivided earnings expended in improving the property, and no little is compensation for loss of interest during construction. On the whole, this particular steam devil is not so black as he is painted.

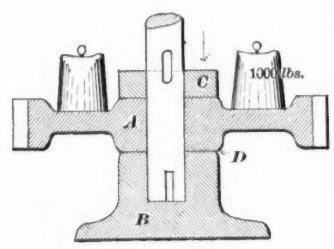
J. C. HOADLEY.

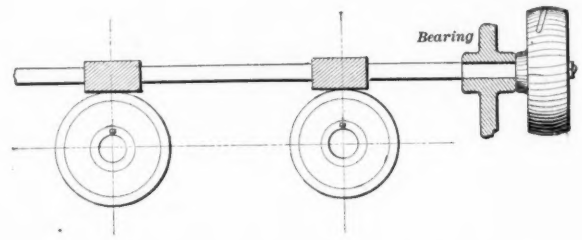
Something About Friction.

Editor American Machinist:

By yesterday's mail I sent you a query on this subject, but since then, having become involved in unfathomable arguments with a friend, there seems to be no possible settlement without a resort to the arbitration and decisions of yourself and contributors.

The accompanying sketch represents in vertical cross section a gear wheel *A* revolving on a stationary shaft fixed in the stand *B*. *C* is a collar which can slide on the feather as shown, but does not revolve. If now there is placed on gear *A* 1,000 pounds of weights, evenly distributed, it produces friction on bearing at *D*, and we may assume that it takes one horse-power to drive *A*. Now, our opponent asserts





that if the 1,000 pounds is transferred from the gear *A* and placed on the collar *C*, that the friction will be doubled, or in other words that there is 1,000 pounds on each bearing, which, therefore, becomes 2,000 pounds, and requires two horse-power to drive gear *A*.

I am willing to admit that practically there might be an increase of friction owing to the increased surfaces not being theoretically perfectly smooth and lubricated, yet it seems to me that the same 1,000 pounds is still making the pressure which produces the friction, and to assume that it is doubled is very much like the two fellows pulling on a rope, each pulls his 200 pounds, but there is only the 200 pounds on the rope for all that.

I would like to know what has been done to increase the friction by placing the weights on the collar *C*. We have not increased the pressure, as the 1,000 pounds is the same in both cases. We have increased the surfaces in contact, but by my translation of the laws of friction this does not affect perfect surfaces, therefore from whence arises this double friction? My opponent says it is logic that there is 1,000 pounds on each face independently, which must foot up 2,000 pounds, and so on by progression through a dozen or more. Is not this pressure merely distributed, and can some one prove it to him, or am I the guilty man who needs enlightenment? If so I hope for instruction on the subject.

Another question which more or less hinges on this point results as follows: In the sketch we are supposed to have a top view of two worms and worm wheels, the worm shaft being driven by a pulley at its extremity. We will suppose the two worm wheels to be engaged in doing work, say each is turning a screw to raise 20 tons. How much friction is eliminated by the use of right and left hand worms, instead of two rights or two lefts, with threads of screws to suit each case (that is, right or left)? By using worms with opposite thrust we do away with end thrust on shaft collar, which is converted into tension or compression of shaft according to the gearing, but the work to be done, that is, the pressure between worm and worm wheel teeth is still there; now how much less power will it take to drive the pulley with the friction concentrated on the teeth alone, than when, with similar worms, it is transferred to the thrust collar as well?

Thirdly, Will it take more power in the prime mover to do a given amount of work with a fine thread screw than with a coarser thread, geared down to give the same travel per minute? And how would the friction of the coarse thread compare with that of a finer double thread of the same pitch? This point I have not thoroughly digested, and I merely suggest it for the discussion of some of my fellow readers. Another point which might be added; suppose a shaft revolving in two bearings, say engine pillow blocks, will there be more friction if weight is added to the shaft, than if it were distributed on the caps of the two boxes?

This paper has dwindled down from discussion to query, but I am in hopes it will develop matter that will be interesting and instructive to many of us. One law of friction tells us that friction is independent of extent of surface; and another, that it is greater between rough surfaces, and diminished by lubrication. Now, as all surfaces are more or less rough, and lubrication more or less imperfect, it must practically result in an increase of friction when surfaces are increased, unless the surfaces are ridiculously small for the pressure, but is the friction doubled by doubling the surface as shown in the first sketch?

U. SHORT.

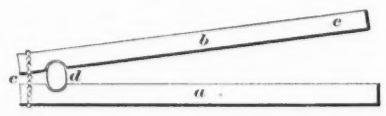
Extemporized Tools.

Editor American Machinist:

Your article of May 29, on a novel vise by clamping between the driver and air brake, reminds me of the different ways I have had to do for a vise in the country on repairs.

For filing brasses; etc., I take two boards *a* and *b*, about three feet long, place a block *c* at bottom, the thickness of whatever you wish to clamp; then by means of a bolt or a stout cord put around the boards and twisted up with a stick, you can hold anything so as to do filing.

For a pipe vise I use two timbers *a* and *b*, eight or ten feet long, with a chain or bolt at



c, also hollow out places in each timber to fit over the pipe *d*, then with a heavy man to put his weight on at *e* you can cut threads or take old pipes apart.

It is all very plain sailing in a shop where you have plenty of tools and a boss to tell you how to do a job; but when you get out in the backwoods to do some repairs on an engine, with nothing but a few tools you take along, you have got to make the best use you can of what you have at hand, or else go back to the shop "stuck."

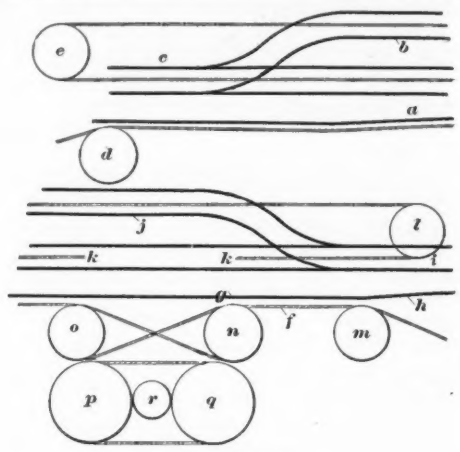
G. A. CARPENTER.

Remedy For An Air Pump Trouble.

Editor American Machinist:

A correspondent to your paper of May 29, signing himself T. Paxton, asks some questions relating to an air pump of the Westinghouse make, used for air brake purposes. From the description given by him of the repairs made, it is evident that the work was properly done. On two different occasions I have had similar experience; in the first case it was some time before I discovered the cause of the pound, same as described by Paxton. The cause of the trouble was in both instances so simple that I felt almost ashamed of not discovering it sooner. By making the brackets, or braces, by which the pump is fastened onto the engine sufficiently strong, and bolting the pump firmly to the place, the jar can be stopped. The pump is, no doubt, loose on the braces.

Laramie, Wyo. H. BREITENSTEIN.



CABLE SWITCH.

Cable Railroad Switching.

The North Hudson County Cable Railroad, has perfected arrangments for switching their cars at their upper station, so that the cars are transferred beyond the station, instead of in and before it as at the lower or ferry station.

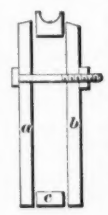
No switching engines are used on this road, as is the case on the Brooklyn Bridge; gravity and momentum of the car, doing the work of transfer.

At the ferry station, the car comes in on track *b*, which is inclined considerably as shown at *a*, which is an elevation of track and cable.

The car stops at *e*, and is ready to start on its outward trip without further trouble. The cable passes around the pulley *e*, which is placed upon an incline, and serves to tighten the cable, by being moved outward. Two wheels like *d*, one to each cable, form a guide to the cable while passing from the incline to the plane of the track.

At the inland station, the car comes in at, and stops at *k k* to leave passengers. If by mistake of the gripman, the car is stopped between *k* and *k*, there is no method of starting it, except by barring.

At *k*, the cable is picked up and the car run to *i*. As will be seen by the elevation, the cable drops to the tightening incline, as it passes the pulley *m*, therefore the cable must be let go in season, or between *n*, and *m*.



After dropping cable, the car runs to *i* by momentum, and begins to run back as soon as the brake is off. The inclined plane *h* is arranged for this purpose.

The car is stopped at *j*, and receives passengers for its return trip. Between *k* and *k* the cable passes to the driving drums *p* and *q*, over the guides *o* and *n*, as described in the AMERICAN MACHINIST of March 20.

The speed of the cable engine has lately been increased from 44 to 48 revolutions per minute, increasing the speed of cable from nearly $9\frac{1}{4}$ per hour, to a little more than $10\frac{1}{4}$ miles per hour.

Since the speed was increased, the motion of cable does not seem as steady, giving the cars a jerky motion, especially when starting up grade.

This trouble is undoubtedly caused by slack in the cable, or by irregular motion of the tightening pulley on the incline at either end of the road.

The tighteners are now held by a section of cable, which is made fast to the tightener carriage, and to an anchorage.

An even vibratory motion given to the tightener, would in the estimation of an engineer, prevent the unsteady motion of the car.

As showing the ignorance existing in regard to boilers and boiler explosions, the *Mechanical World* notes the evidence of a witness in a boiler explosion case. The explosion was caused by the giving way of a "copper spherically-shaped pot, suspended over the fire from the crown-plate." The witness referred to testified that, in his opinion, the explosion was not caused by over-pressure, "because the pressure was too far away from the pot."

A "Box" Jig.

BY C. E. SIMONDS.

The illustrations show a fixture known as a box jig, the name being given on account of the work being inclosed or shut up as in an ordinary box.

In designing this fixture the first move is to make a complete end view of the bearing of Fig. 8. Next, provide some bearing points which will always locate the work each and every time alike.

In Fig. 8 are shown projections marked *E E* giving as they do suitable points for resting on the angular parts marked *A A A A*, shown in Figs. 1, 2, 3, 5 and 7. Now, by making an end view of the piece, we find out what is needed for the width and height, so that the elevation and plan views may be finished.

The next move would be to fit round plugs into the cored ends of the lower half of the fixture tight enough to prevent their moving, but not so tight as to spring the hubs or bosses, marked *K K*. Next, face off the ends of *K K*, then turn them both to a size. After this, place them upon the crotch or *V* pieces on the planer and surface off the bottom of the casting, always taking a finishing cut after the roughing one. Have this surface smooth, because fine lines are to be made, locating the different positions of the bushings or guides for the drills.

Plane the inside edges of the fixtures, taking again a finishing cut, then take the upper half of the fixture, and fit into the lower half. Have the top surface finished, as lines are to be drawn locating bushings directly in line with the lower half; also face off enough of the front edges of the upper and lower half to give room for the square in transferring lines across the fixtures.

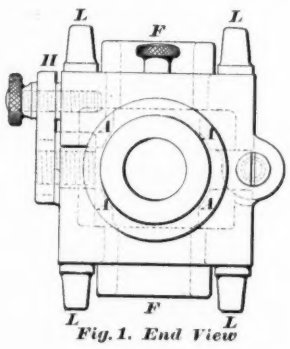


Fig. 1. End View

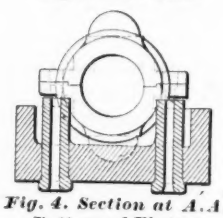


Fig. 4. Section at A.A. Bottom of Fixture

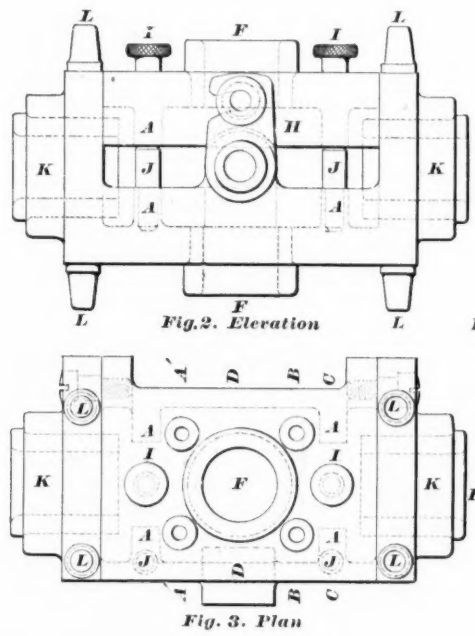


Fig. 2. Elevation

Fig. 3. Plan

BOX JIG.

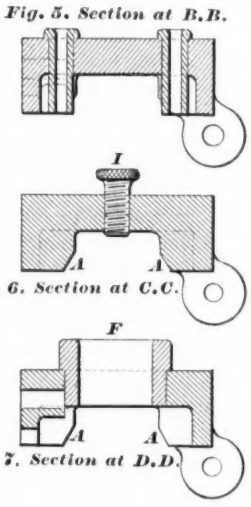


Fig. 5. Section at B.B.

Fig. 6. Section at C.C.

Fig. 7. Section at D.D.

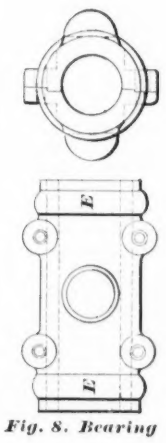


Fig. 8. Bearing

Before planing the surface of the top half of the fixture, fit the screws for the hinged part; also have the stop pins *J J* in position, having them made with a shoulder to prevent them changing their original position.

Have the surfaces bearing on top of these pins square. Next, fit the latch *H* in position, so as to bring the two parts together and hold them in position. Have the latch fit so no play will exist between the two surfaces. When the two surfaces are together, surface off the top part so that it will be parallel and true with the bottom surface for reasons explained further on.

The next operation will be to make a size-plug for boring parts *K K* and angular surfaces *A A A A*, shown at Figs. 1, 2, and 3, likewise 5, 6 and 7. The largest part of the size-plug will be for the outside diameter of the bushing fitting in *K K*; the smallest diameter of plug will be for the part marked *E E*, Fig. 8.

The object of this plug is to bore both ends *K K* alike. As the fixture is in condition to bore the holes in the ends *K K*, place the stationary rest on the lathe, then put the fixture on the centers, provision being made for keeping the fixture up and against the live center. The dead center is removed for boring. It is supposed that the jaws of the stationary rest have been fitted down on the turned part *K K*. The plug in the end to be bored is then removed, and the boring commenced.

After the large hole is bored, proceed with boring the angular parts *A A* until the smallest diameter of the size plug will go in. To notice how the smallest diameter of the size-plug fits, the upper part of the fixture can be opened and the boring examined while he plug is in the lower half.

When the first end is finished, fit in a new plug, then reverse and finish the other end. After the holes have been bored, the angular parts *A A A A* can be planed or left as bored; it is well to plane them on an angle until the bearing is almost removed, so as to make the point of contact of the circle *E E*, Fig. 8, alike in each fixture, for if one part was bored and the other planed, some slight discrepancy might occur. This will be better understood by drawing a circle the diameter of *E E*, Fig. 8, and then drawing angular lines touching the circle.

The only objections being that the fixture used for planing or milling the bearing, Fig. 8, would have regular points for the circle to bear on, and as some roughness might exist in the casting, especially above the point where it rested in the milling fixture, and with the supposition that such did exist, it will be seen what trouble would occur if the bearing points *A A A A* were circular, instead of angular. The object of boring the parts *A A A A* is to act as a guide in placing them central with the bushings.

Now, if the circle could be constructed in the planing or milling fixture, it would be best to adopt the circular bearing in both fixtures; but, as the milling or planing fixture holds a number of the parts, it will be seen that it would be a difficult job to bore the milling fixture circular. It is important to have both bearing spots alike in each fixture, should the work be of such a nature to require it.

Next, clean the surface with emery paper, and wet with a solution of copper dissolved in nitric acid, to which a small quantity of water has been added after the copper is dissolved.

This treatment deposits a thin film of copper on the parts so wet, and allows lines to be seen plainly when they are drawn upon the surface. Rub it over the surface. If it is too strong, the coating will scale off. If such be the case, add more water.

The value and use of this solution in machine work is not known as well as it might be. One great advantage in its use is that after it has been applied water or oil will not affect it, as the lines are still sharp and bright.

It will be found that, should any grease from the hands be left on the casting after filing or planing, the acid will take to the surface, but by cleaning the surface the solution gives a brighter color.

In locating the lines, make one through the center of the parts *K K* both top and bottom of the fixture. From this line all others are drawn parallel and at right angles with each other, as the location of the bushings are such in the upper and lower half of the fixture; also the points, called legs, shown at *L L L L*; also the adjusting screws *I I*.

Now, in laying out these different points, start in the center of the fixture or bushing marked *F F*; then with the dividers lay off the other distances, as shown now in this fixture. With the exception of the binding screws *I I*, the location of the holes are the same distances apart in upper and lower parts.

As the edges were planed for a short distance in the upper and lower parts, the square can be used for making the lines at right angle with the center line. After all the lines have been located, make a fine point with the center punch, being sure that the fine point is exactly in the center of both lines. Now, to prove whether the center punched hole is in the right position, take two pair of dividers, set the points of one pair for the greatest distance, the other pair for the shortest distance; then, after the point has been made with the center punch, try the points of the dividers in the fine center punched holes. If the points of the dividers do not spring either way, it is safe to conclude that the location is right. Next, from each of these points scribe a circle at least one inch in diameter, deep enough to support the point of the dividers; after the circles have been scribed, the fine point can be made deeper for the purpose of drilling. As the drilling proceeds, and before the drill cuts the required size, take the dividers and set one point in the line scribed, then set the other point as close as possible to the edge of circle made with the drill. Repeat this operation at four different points.

If the point of dividers does not come to the edge of the circle made by the drill, the side of the hole which shows the greatest distance from the one-inch line described, is the part to be cupped in a light manner with the cupping chisel made for the purpose. Start drilling again, and try the dividers, as before, until the two circles measure equal distances apart at any four points taken with the dividers.

This method applies only to a fixture where a slight error would not affect the work. Strict accuracy is not required in this class of work. Constructing fixtures accurately will be treated in another article. As regards the bearing points *L L L L*, these should be made of tool steel, hardened on the ends, and the points rounded so as not to scratch or dig into the platen or surface which they are to be used on. Some claim that there is no need of hardening, but the writer differs for the reason that as they are the foundation or working points, they should be preserved.

In a great many fixtures they cannot be hardened, owing to there not being any means of grinding them after they are inserted in the fixture. In this case they should be made with a large bearing surface, and made of tool steel from the bar, without annealing, driven to a shoulder; in all classes of fixtures, and where grinding cannot be done, they should be planed resting upon the planed surface of the fixture, placed upon parallel pieces free from winding.

After the fixture is completed, place the work inside of the fixture, close the upper part, being sure that it comes down on the stops *J J*. Adjust the latch *H* in position. As leeway exists between the work and inside of the fixture, a cupped stop, temporarily placed in one of the bushings *F*, prevents the work moving endways. While boring the hole for the shaft, the screws *I I* bearing down on the parts marked *E E*, Fig. 8, prevent the work from opening while boring the hole, as will be seen in section, Fig. 4.

The bushings are made so as to come near the surface of the ears of the bearing, both in the upper and lower half of the fixture, thus preventing the bearing from turning in case the gauge was not inserted in the bushing *F*. The object of the writer in selecting this form of fixture was for the purpose of showing a form of box jig, and at the same time the amount of bushings required for a simple bearing as Fig. 8.

Cable Railways in Chicago.

Chicago cable railways seem to be giving excellent satisfaction in their operation, and there will soon be important extensions of the system. There is good reason for believing that it will be gradually adopted by most of the long lines. The cars are generally run in trains of from two to five. The speed being eight miles an hour, they afford comparatively rapid transit. Stopping and starting is done very smoothly, and without reason to apprehend accident. The maximum speed is quickly attained, much quicker than with a single car drawn by horses.

The motive plant is good in almost every respect. At first two pairs of engines, 24″x48″, were placed, the calculation being that one pair would do the work, the other pair being always ready in case of an accident. It was found that one pair of these engines were hardly sufficient for the work and a pair 30″ x60″ were put in. These are run at 65 revolutions, and furnish ample power. At some seasons of the year, one of the smaller pairs is plenty large enough, and can be made to do the work at any time, as in the instance of a break-down of the larger pair. So one small pair will be kept for these purposes, and the other will be removed to another location, where power for similar purposes will soon be required.

When the plant was first started, coal was used exclusively for fuel; at the present time the refuse from horse car stables is used. A small quantity of coal is kept incandescent at the front of the furnace, to avoid the possibility of the fire getting entirely out from inattention. A fan driven by a small engine furnishes from one to two ounces of blast to the furnaces. The boilers steam well with this fuel, which costs nothing, since it is a convenient way to get rid of it.

About the time the "largest steam hammer in the U. S." was erected some years since, at Nashua, N. H., an extensive high school building was erected some 2,000 feet distant from the hammer.

The concussion of the big hammer nearly destroyed the school house. The plaster on ceiling and walls was cracked in every direction; the walls were also cracked, and the safety of the building seriously threatened.

A mechanically inclined Frenchman has had constructed a bed which wakes him up at the desired hour by means of a chime of bells; then lights a candle, pulls off his night cap, and starts up a self-acting coffee pot.

If the sleepy Frenchman don't get up by the time coffee is ready, the bed rises bodily on end, and deposits its lazy occupant upright on the floor.

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NEW YORK, JUNE 19, 1886.

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The Mechanical Engineers at Chicago.

The recent meeting of the American Society of Mechanical Engineers, at Chicago, will be held in remembrance by those who attended it; not so much from any importance attaching to the papers presented, as from the hearty Western welcome with which the visiting members were received, and the prodigal manner in which they were entertained by the resident members and by the citizens. In these respects this meeting surpassed all previous meetings. There are many places of interest to mechanical engineers in and around Chicago, and these the badge of the society answered all the purposes of a ticket of admission to. The local committee were industrious in the work of making the meeting a success, and deserve praise for the manner in which they accomplished their ends. Excursions and banquets were tendered, in which many citizens not members of the society participated. The weather was pleasant, and with the facilities provided for seeing the city many Eastern members went home with a high opinion of the present greatness and future prospects of the Western metropolis.

Of the papers presented, more than the usual proportion related to subjects not, strictly speaking, of an engineering character. But these papers were, judging by the discussion they brought out, of greater interest to the members present than those more specially relating to their work. Considered as an addition to the literature of mechanical engineering, and taking the papers presented as a whole, the work of this meeting is not up to the standard of the society.

One of the papers presented contained a proposition to organize a distinct section of the society to consider economic questions, which, so the writer appeared to think, might be considered as outside the primary objects of the society. Happily, we think, the members showed no inclination to move in the direction indicated. If a paper cannot be classed as in a fair degree coming under the head of something with which a mechanical engineer in his legitimate work *may* need to be familiar, it should not be presented at a meeting of the society. If it can be so classed, it should be presented and discussed precisely as any other paper is. It cannot be expected that all members will be interested alike in any paper that is read; if it comes to dividing up into sections to suit individual tastes it will require a good many sections and a good deal of engineering and financiering to keep the society going. If it is considered in the light of adding something foreign to the purposes of the society, it appears to be still more objectionable, at least until such times as the society has a surplus of funds in hand.

The new rules, providing that only five minutes shall be allowed in which to present the salient points of a paper with which the members are supposed to have made themselves familiar, through the printed copies previously furnished, worked well when enforced. In one case, and that in the instance of a paper discussing educational topics, which could be much better understood without an explanatory synopsis than papers treating intricate mechanical subjects, the author was permitted to occupy a half hour in its presentation. If any infraction of the five-minute rule is to be permitted, it should manifestly be in favor of such papers as require some explanation, or very careful reading and some study, to make them clear.

In at least one instance a lengthy written discussion was presented, much of which was not a discussion of the paper to which it was referred. Such things are perhaps unavoidable, but unfortunate, nevertheless.

The "Topical Discussions" were one of the most interesting features of the meeting, and one in which the interest is likely to increase. This, with the discussion of regular papers, even with the five-minute rule, crowds more work into the sessions of the society than there is fairly time for, making it necessary to cut off much interesting argument. At least this was found to be the case at Chicago, notwithstanding the commendable dispatch with which the vice-president, in the absence of the president, got through with all matter of a purely business character.

The informal banquet tendered the members after the first session was a very pleasing affair. The banquet at the Grand Pacific Hotel was unanimously voted immense; it was participated in by nearly four hundred people, including a fair number of ladies. Appropriate toasts were very happily responded to.

The excursion took in the stock yards, the works at Pullman and the steel works at South Chicago. The stock yards and packing establishments were mainly interesting in showing the magnitude of their works; the Pullman works showed good examples o architecture, but the steel works excited the interest of the excursionists in that they had opportunity to inspect one of the best works of the kind in the world. Every operation, from the melting of the iron, which does not get cold until it appears as a finished steel rail, was watched with much interest.

On Friday carriages and steamboats were placed at the disposal of the members, and used for visiting manufacturing establishments, the "Crib," from whence Chicago's water supply comes, the pumping stations and other points of interest. Altogether, the hospitality of Chicago will be proverbial amongst mechanical engineers.

English and American Freight Rates.

Thoughtful persons must have noticed within the past few months an unusual number of articles in daily and weekly papers and magazines on the relations of railroad corporations to the general public, from prominent men who have not been accustomed to write upon such subjects. These articles have almost all been written from the corporation standpoint. The well-known engineer, J. C. Hoadley, sends us a communication which appears in this issue comparing English and American freight rates. The rates for short hauls in the "tight little island" are compared with trunk line rates in this large country. The longest haul Mr. Hoadley mentions is barely two-thirds of the distance across the State of New York by way of the Central or West Shore Railroads. Trunk line rates are based upon transportation without breaking bulk over three to five times the longest distance he mentions. But most of the rates Mr. Hoadley compares are for less than a hundred miles. This does not give a fair basis for comparison. It is almost like comparing the prices of a penny grocery with those of a large wholesale establishment. English freight rates, however, are excessively high, and both the press and people of that country are making strong efforts to have them reduced. Some time ago we mentioned in these columns a large manufactory in the interior of England which was moved to the seaboard at large expense, but the saving in freight would amount to enough in a very few years to pay the cost of the entire plant.

If railroad corporations wrong the public in any way, and are arraigned before a court for the same, they would not expect to escape by pleading that the roads are a great public benefit. But the public are expected to excuse all the offences of railroad corporations on that ground.

Mechanical Wiseacres.

At regular and frequent intervals some mechanical wiseacre makes, in his imagination, the alarming discovery that there is a constant falling off in mechanical skill; that mechanics thirty years ago were much more competent than they are to-day, and that in this respect things are getting altogether bad. There is never an atom of evidence going to show that there is any truth in this statement, but a good many well-meaning men believe it, and proceed to set up ingenious theories to account for the assumed fact. Of all statements that receive almost universal credence, this is by odds the most stupid. Thirty years ago it was comparatively rare to find mechanics who knew more about the trades they followed than was required to enable them to use the tools they worked with. When there was one who studied beyond this he stood out phenomenally, by contrast. At the present time all mechanics study literature relating to their trades, and many of them are close students of the principles of mechanics.

But methods have been changed in thirty years, and a good deal of work that was done then by skilled workmen is now done by those who do not pretend, or at least more than pretend, to be mechanics. Machinery which requires only the attention of a small amount of special skill is made to do much of the drudgery formerly done by the mechanic, hence it is common to find a good many men working in the trades but not at the trades. These are ranked by the superficial thinker as mechanics, and compared with those of the "old times." The mechanic of to-day who has learned his trade is, as he should be with the advantages of better facilities and immensely better opportunities for reading and studying in the proper direction, much better able to follow it intelligently than he would have been thirty years ago.

It would be just as reasonable, and quite as correct, to argue that business men were less proficient now than formerly, because they have come to make use of specialists in various departments of business; men who make no pretensions to an understanding of more than the particular part they do. But no one would believe this.

Akin to the wiseacre who sees ruin in the waning abilities of the mechanic, is the one who, seeing things quite differently, but equally falsely, evolves the conclusion that machinery has done away with the need of skilled mechanics. Skill of a high order was never more in demand, and it will never come in any trade where machinery can do away with the necessity for it.

As we have at different times pointed out there is danger that a disinclination on the part of manufacturers to take apprentices may make the supply of the right kind of mechanics scarce, but then the demand for them will be still greater. In any event they will be more skillful year by year as long as the world continues to grow wiser.

The American Railway Master Mechanics' Association, which holds its annual convention in Boston, beginning next Tuesday, is one of the most practical and useful mechanical societies in this country. Many of the important railroad improvements, especially those in the line of uniformity and standards, owe their adoption to this Association. The reports of the various committees are prepared after making extensive inquiries by circular, and are reliable and valuable. Discussions always bring out novel and useful facts about railroad shop practice and the use of particular devices on locomotives.

The change of gauge of nine or ten thousand miles of Southern railroad to the regular standard last week, was accomplished very smoothly. Traffic was suspended for a day or two on some roads, but the business was pushed as soon as the rails were changed, so as to make as little inconvenience as possible. This change is of the greatest importance, as it does away with the shifting of trucks when running cars from one road to another of different gauge. A number of new locomotives will be ordered, and the repair shops of many roads will have extra work for a time.

In our issue of June 12, the omission of a decimal point in the article "Soda Ash for Cleaning Boilers," makes it read 80 of soda carbonate. It should be .80.

Literary Notes.

A new sixteen page illustrated journal, named *Tobacco*, has just been started in this city by T. H. Delano & Co. It is devoted to the interests of retail dealers in cigars, manufactured tobacco and smokers' articles. It is independent, and proposes to keep dealers informed in those matters that lie nearest to their interests. The first issue is bright, newsy, and well edited. Subscription is $2.00 a year. Publication office 102 Chambers street.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(241) G. H. C., Silver Springs, N. Y., asks where he must apply to obtain a certificate as stationary engineer? *A.*—No certificate is necessary, outside of the large cities, for the State of New York. For marine or lake service apply to the inspectors of your district. In New York City, engineers' certificates are granted by a police board.

(242) E. W. P., North Abington, Mass., writes: I wish to work brass wire while it is soft, and then harden it to a spring temper. How can I do so? *A.*—We do not know of any method of hardening brass such as you wish. Spring temper in brass is obtained by a peculiar treatment during process of manufacture.

(243) A. F. D., New Orleans, La., asks: Will a steam boiler generate more steam theoretically, when set at 1½′ or 2′′ lower at the back than at the front end? *A.*—No. 2. There are four double-flue boilers, 42′′x30′′, connected by four legs to four cylindrical boilers, 32′′x30′, so as to be heated by bagasse, with the assistance of forced draft. Now, according to my knowledge, the boilers being of equal length, the expansion and contraction goes on equally, so as not to affect the legs materially. Some one says that this action tends to loosen the legs, if not to crack the boilers. As this arrangement is to be put to practical purposes soon, I would ask your opinion. *A.*—Several forms of boilers are constructed in a similar manner. They are said to work fairly well, yet we should not advise this form of boiler. There is danger, in case of very sudden changes in temperature in double-flue or in cylinder boiler, that a rupture will be caused by unequal expansion or contraction. 3. In lining up engines, mills, etc., with sulphur, is not water coming in contact with the sulphur liable to injure the bed-plates? For instance, if the lining of a sugar mill be sulphur instead of cement, is not the cane juice, which is at all times liable to come in contact with the sulphur, capable of generating sulphuric acid, which would soon eat away the bed-plate? *A.*—Pure water will not materially injure the sulphur, but the action of cane juice we have no means of determining. We should, to be on the safe side, use lead in place of the sulphur. 4. If you have it in mind, please recommend some good recent work on hydraulics or pumping machinery (steam); I mean a work that treats of the pumps of to-day, and not those of old. *A.*—Write to makers of different kinds of pumps. Their catalogues contain much desirable informaton upon the subject.

(244) C. S. B., Bennington, Vt., writes: Supposing something is sent to me from England by freight or express, and directed to me away out in the country somewhere, I having notice by mail that this something has been sent, and know that it must be dutiable, but do not know on what ship or by what line it has been sent. How must I go to work to get it? *A.*—Write to the sender, and consult a custom-house broker.

(245) J. McK., Winnipeg, asks how to work mushet steel? *A.*—Forge as in working ordinary cast steel, but be very careful not to heat hotter than a dull red. After the tool is shaped lay it down to cool, without hardening or tempering. When cold, grind and use.

(246) L. T., Penn Yan, N. Y., writes: I am going to build a 16x24 engine for running a saw-mill. I wish to use steam with as much economy as possible. My cylinder will be of that kind that has a valve on each end. With the two valves connected by a rod, my steam ports will be 14′′ wide, ⅞′′ thick; bridges, ⅞′′; exhaust ports, 14′′ wide, by 1¾′′; steam lap, ¾′′; travel of valves, 3⅜′′. Is this right, or would you suggest a change anywhere? 200 revolutions per minute. *A.*—It would be better to make steam ports 15′′x1¼′′; bridges, 1′′; exhaust port, 15′′x2½′′; travel of valve, 5′′; steam lap, ⅞′′; no inside lap.

(247) W. L. E., Hamilton, N. Y., asks what is the difference in the so-called high-pressure and low-pressure steam? *A.*—We do not know of any pressure which is regarded as a limit between high and low pressure Some marine boilers carry 15 lbs. per square inch, and there, over 30 lbs. is regarded as high pressure. Certain railroads use 160 lbs. per steam gauge, and call it high pressure, regarding 130 lbs. as low pressure. In some experimental boilers, any pressure below 300 lbs. per steam gauge is regarded as low pressure, while high pressure is carried to 400 or even 500 lbs. 2. What is 5 lbs. low pressure equal to at high pressure? *A.*—The question is incomplete, and cannot be answered until more definite data is furnished. 3. How many fire and red brick will I need to set a boiler, flush front, 4′x14′? *A.*—Consult a boiler mason who is on the ground, and can tell by inspection of the conditions to be met.

(248) W. J. T. asks if there is any method of softening copper better than heating and plunging into cold water? *A.*—This is the method usually employed. Try heating and cooling slowly, as in annealing steel. It is claimed by some workmen that this method is the best. 2. What is perpetual motion? *A.*—As generally understood, in a mechanical sense, it is, to put the matter in a simple form, a water-wheel which will pump back into the pond all water consumed in running the wheel. In other words, a perpetual-motion machine is a combination of mechanical movements which will give out more power than is put into it. Such a machine is a mechanical impossibility, which no person with a fair knowledge of mechanical principles will believe in, or will waste time or money upon.

(249) G., Baltimore, Md., writes: I have a 15-horse-power locomotive fire-box boiler situated 100 feet from engine, which is connected by 1½′′ pipe, encased in asbestos and wooden box. Will carry about 75 lbs. steam. To what amount in horse-power of steam will pipe transmit, and what will be the loss by condensation, friction, etc., pressed in horse-power. Would the loss be sufficient to justify buying a small engine of 5-horse-power and boiler, and place each beside machinery to be run? *A.*—A rule for determining radiation of heat from pipes may be found on page 438 of *Nystrom's Mechanics*, thirteenth edition. With a well-covered pipe, the loss of conveying would probably not be as much as that caused by running two smaller engines in place of the one now used.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Patent Att'y, H. W. T. Jenner, Washington, D. C.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st, NY

Edw. Sears, Wood Engraver, 48 Beekman st., N.Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Tack, Wire and Shoe Nail Machinery. Wm. A. Sweetser, Brockton, Mass.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., NY

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

"Modern Steam Engines," $6; "Mechanical Drawing Self-Taught," $4 Joshua Rose, Box 3306, N. Y.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Foot-power Machinery, for workshop use, sent on trial if desired. W. F. & Jno. Barnes, Rockford, Ill.

Improved Labor-saving Upright Drills, 20-in. to 36-in., inclusive. Currier & Snyder, Worcester, Mass.

"Morrison's Practical Engineer." A complete treatise (200 pp.) on steam and general mach. Mailed on receipt of $1. W. A. Morrison, Box 373, Lowell, Mass

Engine Lathes, Hand Lathes, and other fine tools, Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

Wanted—Capitalists or manufacturers to buy or make my patented automatic boiler leveling apparatus; correspondence solicited. J. M. Kramer, Maria Stein, Mercer Co., Ohio.

For Sale—Books giving the wheels for cutting screws on any lathe, single or compound gearing. Price, 50 cents. D. J. Mallory, P. O. Box 29, Dayton, Campbell Co., Ky

Bound Volumes of the AMERICAN MACHINIST for the years 1880, 1881, 1882, 1883, 1884 and 1885. These volumes are strongly bound in cloth, and will wear well. Price $3.50 each; express charges additional. AM. MACHINIST PUB'G CO., 96 Fulton st., N. Y.

St. John Improved Self-adjusting Cylinder Packing, for marine and stationary engines and locomotives; applicable to water, air, oil and ammonia pumps. For durability and minimum of friction, it is unexcelled. Send for pamphlet. Address, Balance Valve and Piston Packing Co., room 58, 280 Broadway, New York.

Wanted—Numbers 1, 2 and 4 of volume IV., 1881; must be in excellent condition for binding, if soiled we cannot use them; for copies described as above we will pay 25c. each, and prefer to have the whole three if possible. Parties favoring us will kindly write name and address on wrapper. AM. MACHINIST Publishing Co., 96 Fulton street, N. Y.

Patent Binders for the AMERICAN MACHINIST, holding a complete volume (52 issues), simple, neat, durable. Price $1, prepaid, to any part of the United States by mail. To Canada or foreign countries the price will be 75c.; purchasers pay express charges and customs duties. AM. MACHINIST PUB'G CO., 96 Fulton st., N. Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2, post-paid. Published by John Wiley & Sons, 15 Astor Place, New York.

MANUFACTURES

N. W. Russell is building a foundry at Vinton, Ia.

Samuel Thomas, Birmingham, Ala., will build a blast furnace.

The S. D. & W. S. L. R. R. Co. intend building shops at Dublin, Ga.

McCullock & Burdick are building a foundry at Westerly, R. I.

Welsh & Co. will erect a foundry and machine shop at Groveton, Ala.

George Gilbraith, of Muskegon, Mich., contemplates erecting a machine shop at Washburn.

An iron foundry will be erected at Spring City, Tenn. J. M. Barger, of Athens, will be manager.

It is rumored that the Fall Brook Coal Company, of Corning, N. Y., will build iron works at Tioga, Pa.

The Birmingham, Ala., Agricultural Works, with a paid in capital of $50,000, will soon be in operation.

It is said that Franklin, Pa., is to have a $2,500,000 oil refinery, which is not to belong to the Standard Oil Co.

It is reported that Veasy & White will establish a large factory for grates and mantels at Birmingham, Ala.

It is reported that the Delaware, Lackawanna and Western Railroad will build new shops at East Buffalo, N. Y.

F. C. & V. P. Travers, 107 Duane street, New York City, contemplate erecting a brick factory on Fifty-second street.

The Cragdale Woolen Mill, Talladega, Ala., will enlarge their plant, and, it is reported, will build a cotton factory.

The Shickle, Harrison & Howard Iron Works, of St. Louis, will build a branch foundry for iron pipe at Chattanooga, Tenn.

The Duquesne Steel Co., of Pittsburgh, will erect new Bessemer steel works at Port Perry. Capital stock, $1,000,000.

J. H. Philips, of Canton, Ohio, and T. Woods, of New Orleans, La., will erect a new bolt and nut factory in Birmingham, Ala.

It is rumored that the Dayton Coal and Iron Co., Dayton, Tenn., are making arrangements to build a 100-ton furnace at Spring City, Tenn.

I. L. Ellwood & Co., of DeKalb, Ill., will shortly erect a rolling mill for drawing steel wire of ordinary sizes for making barb fence wire.

New York people have bought a lot in Canaan, Conn., on which to erect immediately a factory for condensing milk by a new process.

Irwin & McLaughlin, Rochester, Pa., have purchased the old Anderson Foundry, which they will repair and place in first-class order during the summer.

The Pennsylvania Railroad has decided to provide additional freight equipment to the amount of $200,000; also locomotive and passenger equipment to the amount of $800,000.

The Union Nail Co., of Omaha, Neb., have bought the old nail works, and are prepared to manufacture nails of iron and steel. Capital stock, $250,000. Wm. Haven, manager.

Gordon, Stroble & Laurau, Philadelphia, Pa., have completed a contract with the Columbus Rolling Mill Co., Columbus, Ohio, for an open-hearth steel plant.

The Tanner & Delaney Engine Co., of Richmond, Va., are building an addition to their boiler works and machine shop, and will put in a large amount of new machinery.

The Strange Forged Twist Drill Co., of New Bedford, Mass., has been incorporated. Capital stock, $15,000. William M. Bates, Edwin Dews, John P. Knowles, Jr., and Thomas Hart corporators.

The Excelsior Foundry and Machine Shop has been incorporated at Birmingham, Ala., with E. R. Jones as president, O. E. Swarts secretary, and H. Houpt treasurer.

The iron foundry previously reported to be erected by Joshua Regester & Sons, Baltimore, will be 100x350 feet, and will employ about 290 hands.—*Baltimore Manufacturers' Record.*

The firm of Warden & Mitchell, Germantown Junction, Philadelphia, manufacturers of boilers, tanks, gas holders, etc., has been dissolved, and the business is being carried on by Henry Warden as successor.

The Clayton Air Compressor Works, Brooklyn, N. Y., employ 25 men 10 hours per day, and work until 4.30 P. M. on Saturdays. No demands have been made for reduction of hours or increase of wages.

A co-operative planing-mill company has been formed by a number of practical mechanics, with a capital of $50,000, at Beaver Falls, Pa. The mill of Wareham, Dodds & Co. has been purchased, and will be refitted with new machinery.

Aultman, Miller & Co., of Akron, Ohio, manufacturers of mowers, reapers and binders, have adopted the eight-hour system in their establishment, with the understanding that it is only an experiment, and if successful will be continued.

Operations have been begun for the establishment of a new foundry in Pawcatuck, R I. It is to be located on Mechanic street, and will be owned and operated by John McCullock and Frank Burdick, moulders in the employ of C. B. Cottrell & Sons.

The *Industrial Journal* says: "Work has commenced on the new machine shop at Presque Isle, Me., and will be pushed to completion as rapidly as possible. The proprietor is Mr. Banfill, of St. John, who already has part of his machinery on the ground.

Through an error which crept into our issue two weeks ago we coupled the Quintard Iron Works with the firm name of W. H. Wallace & Co. N. Palmer, Jr., & Co., are proprietors of those works, which are running ten hours a day, the wages having been increased.

The Thomas Iron Co., of Pennsylvania, which are already the largest producers of pig iron in this country, will, in connection with others, erect two large blast furnaces in the vicinity of Birmingham, Ala., at a cost of about $1,000,000. The money has been subscribed.

Among contemplated enterprises in Birmingham, Ala., are bolt nut works by Thomas Phillips, of Akron, Ohio, and a cotton factory by C. McCammack, of Pennsylvania. Messrs. Dennis Long and Joseph Barnett, of Louisville, and others, propose to establish an iron pipe business on an extensive scale.

Dean Brothers' Steam Pump Works, Indianapolis, Ind., have issued "Catalogue No. 13" of the steam pumps. It is well printed and illustrated. They make pumps for almost every kind of service. A list of eighteen places is given where their water-works pumping engines are in use, with capacities from one million to two and a-half million gallons per day.

The new shops of the Holland & Thompson Mfg. Co. will be located at West St. Paul, Minn., near the shops (now building) of the Minnesota and Northwestern Railroad. The factory will be a two-story brick building, 50x100 feet, and in connection there will be a foundry 25x50. The capital of the company is $75,000, and the works will give immediate employment to about 50 men, and eventually to 100.

The Boston *Commercial Bulletin* says: "The Dustins, of Dexter, Me., think strongly of establishing a large foundry and machine shop on the line of the Bangor and Piscataquis Railroad in Foxcroft. The stock will be readily taken up. The works will cover three acres of ground, and $40,000 will be required to carry them on. If they are established the railroad company will move thither all their works for repairs and building new cars. Also the manufacture of road machines on a large scale will be carried on."

An addition of 30x40 feet is soon to be put on the machine shop of Baxter D. Whitney's factory, Winchendon, Mass., to be used for a tool shop. Mr. Whitney has just put on the market a 40-inch and a 48-inch 8-roll planing machine, thus increasing the feeding capacity. All gears made here are cast, and in moulding them they are drawn through templets in a special moulding machine, and thus a gear is obtained almost as perfect as a cut gear. A new 42-inch scraping machine is among Mr. Whitney's latest articles put on the market.—*Boston Commercial Bulletin.*

W. P. Davis, North Bloomfield, N. Y., writes us: "We are just finishing a lot of 50 of our drills and key seaters, and have now under way a new lot of 100 machines. Sales have been light for past 30 days, but have been having a very fine trade, especially on our heavy 20′ drill, that is taking well with both dealers and users. We have no trouble with our help as to wages or hours of work, and think if employers and employes would come together and frankly talk over all business matters, there would be but few strikes throughout the country. A misunderstanding is nearly always the cause."

The firm of Henry R. Worthington, of New York, have issued a new edition of their pamphlet entitled "The Worthington Steam Pumping Engine," which was originally designed for circulation at the Centennial Exposition. It is historical and descriptive. Considerable new matter has been added, notably some fine engravings and a description of the Worthington High-Duty Engine, whichwe illustrated a few weeks ago. Worthington compound condensing engines, of large capacity and power, have been erected in nearly 300 pumping stations, with an aggregate daily pumping capacity of a million gallons. Besides these, over 20,000 non-expanding and compound engines, from small capacity to several million gallons a day, have been constructed.

The *Industrial World* says: "The Chicago Steel Manufacturing Company, a new manufacturing enterprise at Hammond, Ind., is erecting a nail factory, which will be 336 feet in length, and 120 feet in width, and will contain 150 nail machines. The plant will be supplied with three furnaces for heating nail plate, two Hamilton-Corliss engines, and four batteries of grindstones, 14 in each battery, with other necessary appliances. The nail factory will be constructed of pressed brick and corrugated iron. The bluing house will also be constructed of brick, and will contain one bluing and one annealing furnace, and will have a separate engine, so that it may be run independently. The works will have a 22-inch nail-plate train for rolling nail plate, which will be driven by a 36x44-inch engine with direct connection, also two large gas furnaces for heating the blooms, and three pairs of shears. The building containing this part of the plant is situated at the south end of the nail factory, and will be 80x200. Another building, composed of brick, will contain a train of rolls for rolling the slabs or blooms from the ingot. Immediately south of this building will be one T-shaped, with iron roof, which will contain three 20-ton Siemens-Martin steel furnaces. In addition to the foregoing, there are also a machine shop, a blacksmith shop, a cooper shop, etc. The works have a frontage of 1,500 feet on the Calumet river, and are located on 35 acres of ground, and have exceptional railway facilities. They will have a capacity for 1,500 kegs of steel nails per day. They are being built under the supervision of General Torrence. Mr. Marcus M. Towle, of Hammond, is president of the company, and General Joseph T. Torrence is vice-president and general manager. The offices of the company are in the First National Bank building in this city.

Machinists' Supplies and Iron.

NEW YORK, June 3, 1886.

There has been no improvement in the demand for iron, and the situation remains the same as reported in our last issue.

In American pig, Standard Lehigh brands are steady, but in some ouside brands there is a tendency to sell. We quote Standard Lehigh and North River brands $18 to $18.50 for No. 1 X Foundry; $17 to 17.50 for No. 2; and $16 to $16.50 for Grey Forge.

Scotch Pig—Without quotable change; dull. We quote Coltness, $20; Glengarnock, $19; Gartsherrie, $19.50; Summerlee, $19.50; Eglinton $17.50 to $18; Langloan, $19.50, and Dalmellington, $18.50.

Copper—Dealers and manufacturers are well stocked. Demand very light, and the price of Lake has declined to 10¼c.

Antimony—Moderate demand. Hallett's, 8¾c.; Cookson's, 8⅞c.

Lead—Dull. Western, 4.65c.; some Chicago sales at 4.55c., and St. Louis for 4.50c.

Tin—There has been a decided advance. Banca, 22¼c.; Straits and Mallacca, 21.95c., cash.

WANTED

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Position as foreman of mach. shop; experienced in machine and tool building; ref. Address West, AM. MACHINIST.

Wanted—A thorough mechanical draftsman and designer, who is well up on locomotive work; must have had experience and good education. Address Box 14, AM. MACHINIST.

Wanted—A young man of good address and thoroughly posted on steam boilers, engines, pumps, etc., as salesman. Address Box No. 476, Philadelphia Postoffice, Pa.

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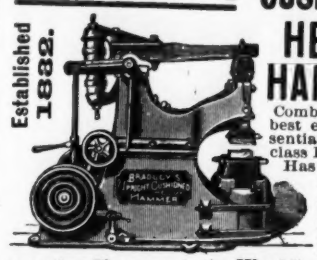

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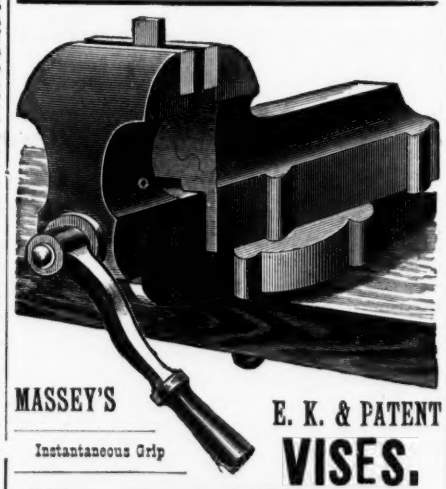

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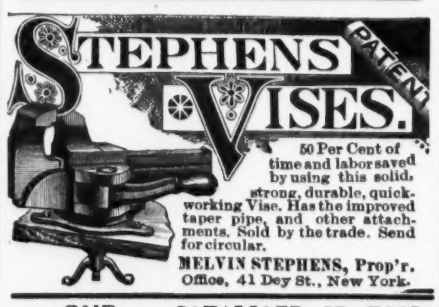

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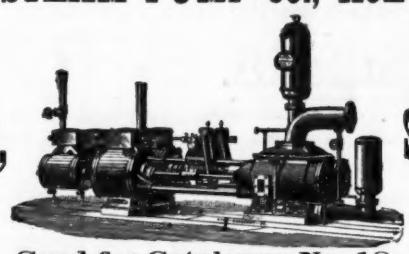

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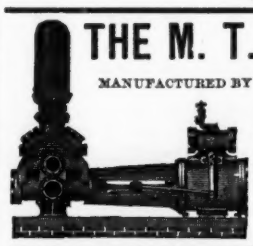

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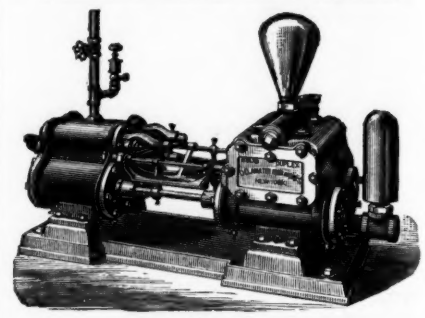

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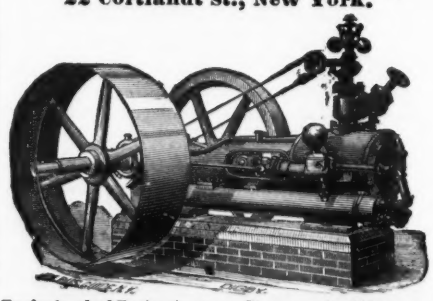

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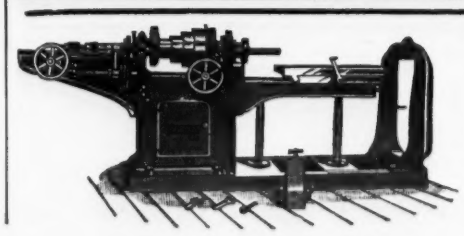

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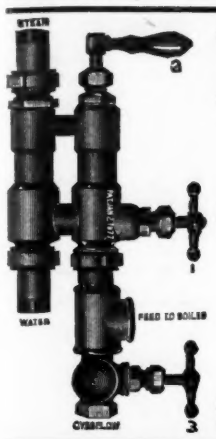

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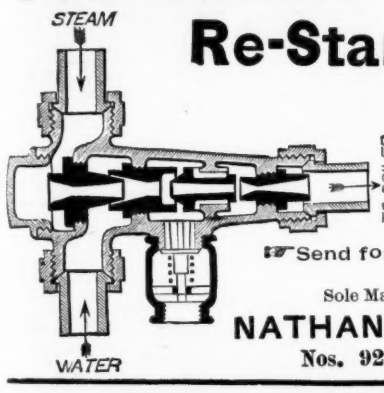

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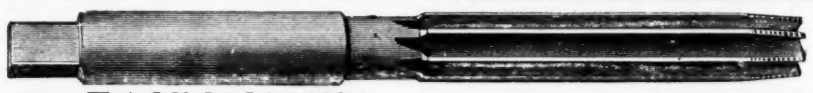

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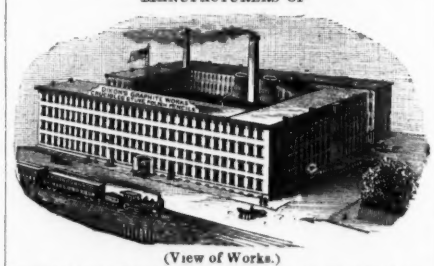

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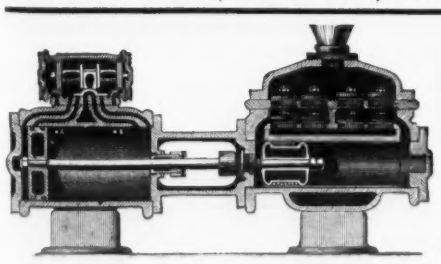

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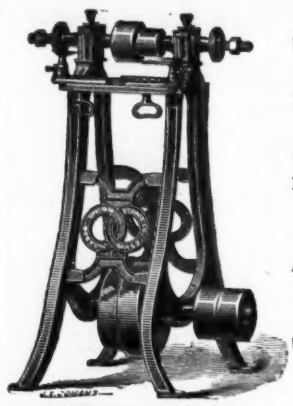

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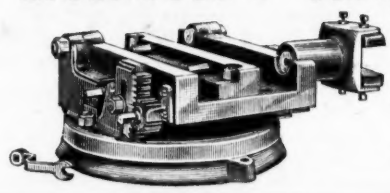

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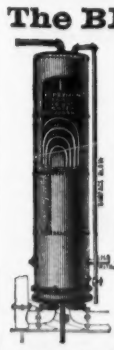

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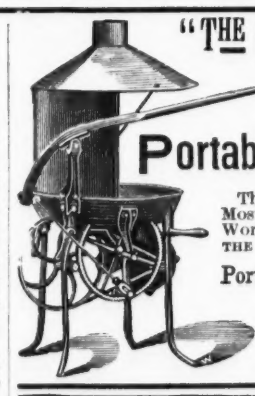

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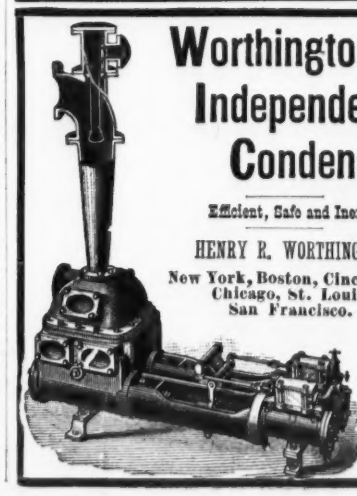

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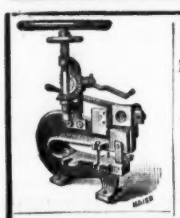
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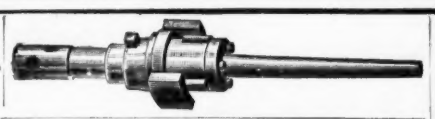

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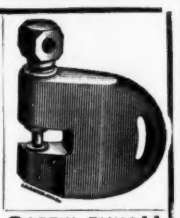
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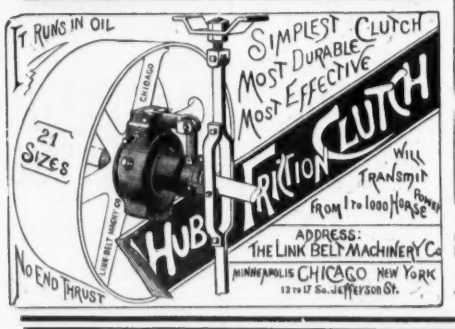

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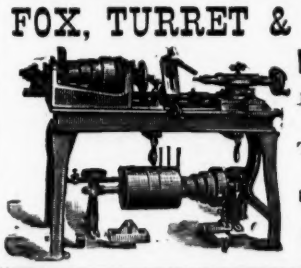

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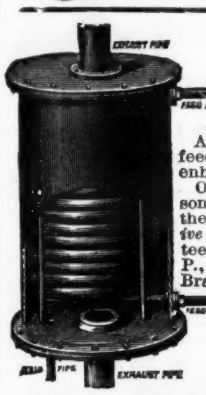

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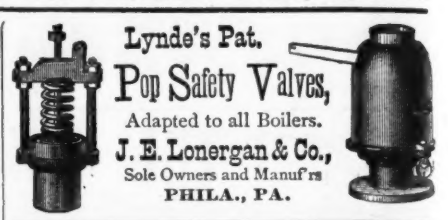

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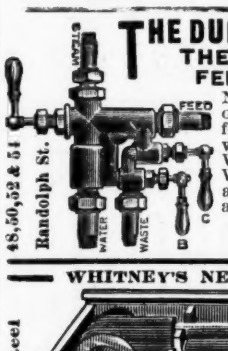

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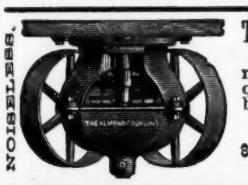

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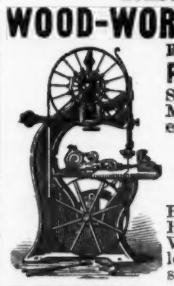

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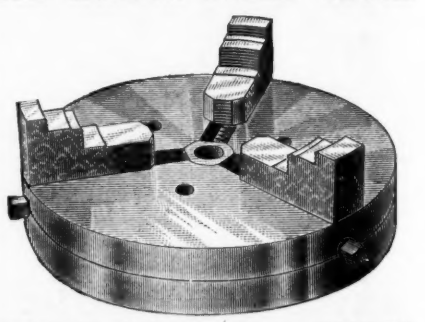

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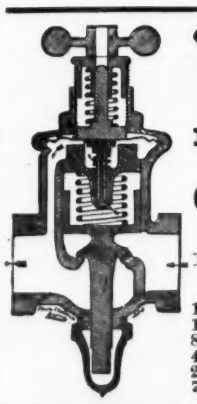

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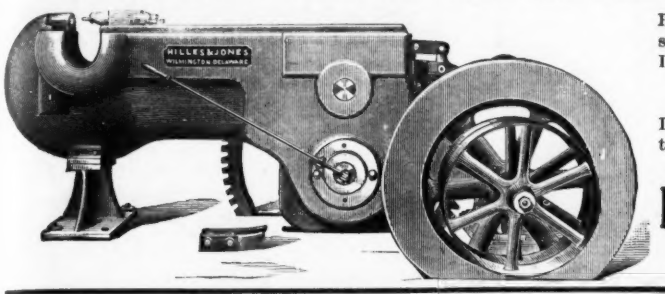

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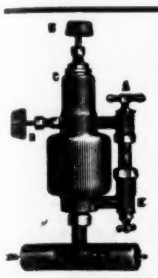

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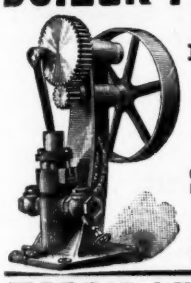

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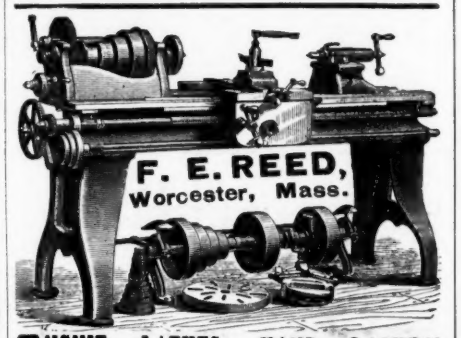

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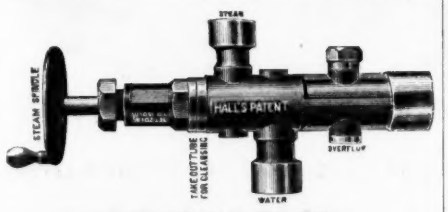

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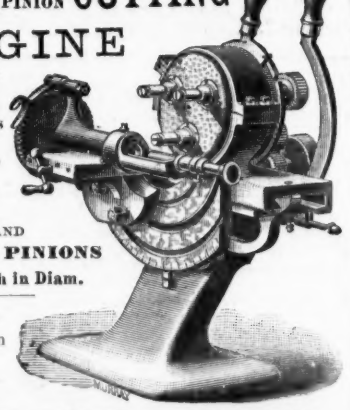

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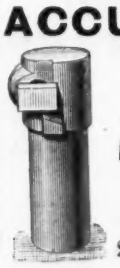

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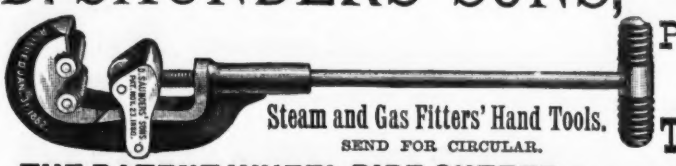

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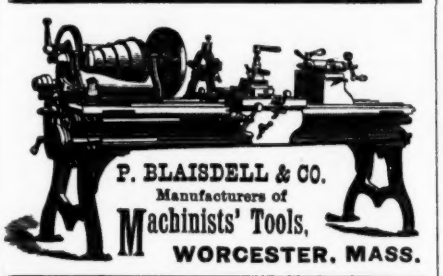

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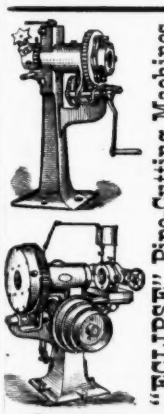

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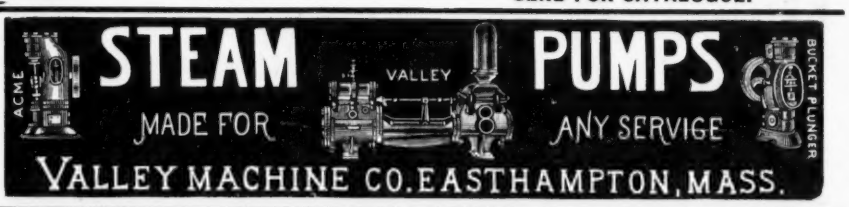

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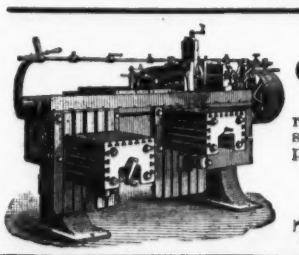

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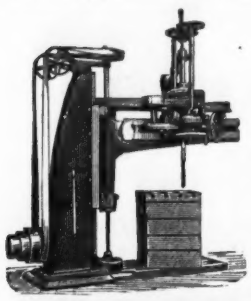

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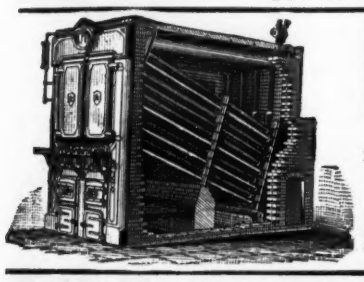

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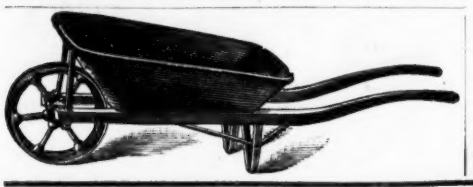

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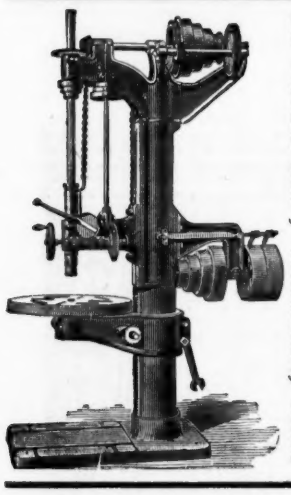

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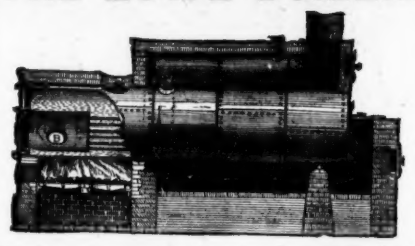

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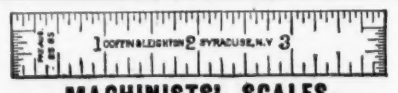

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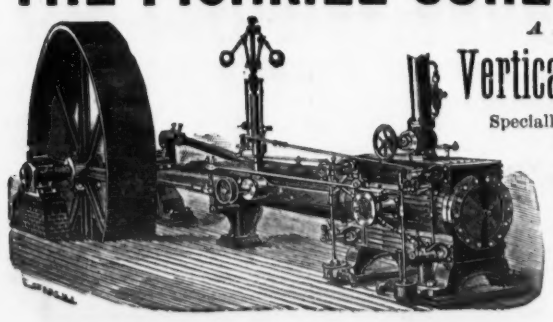

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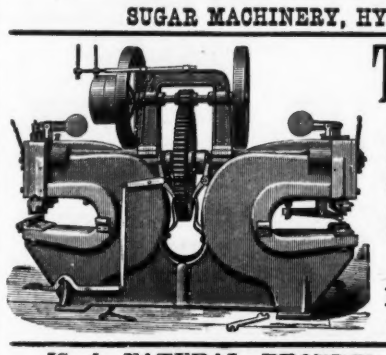

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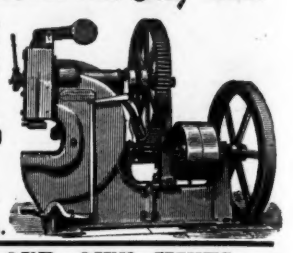

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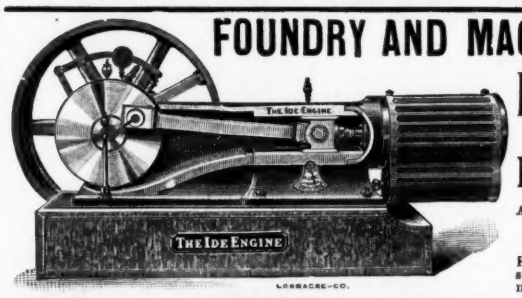

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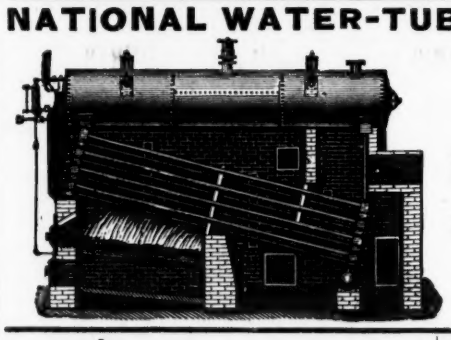

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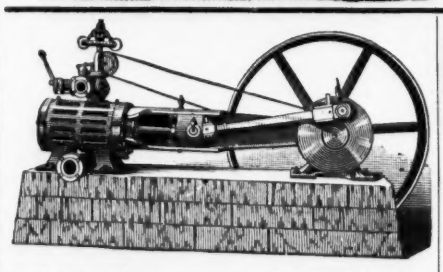

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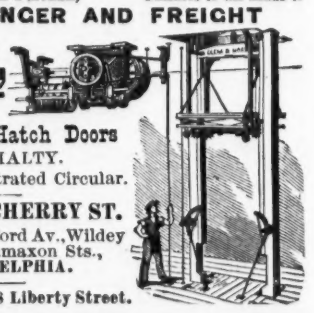

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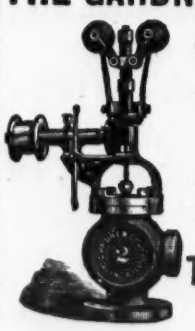

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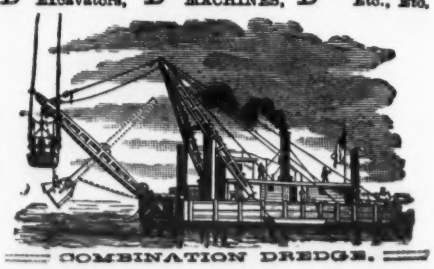

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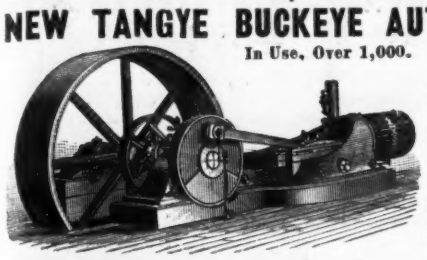

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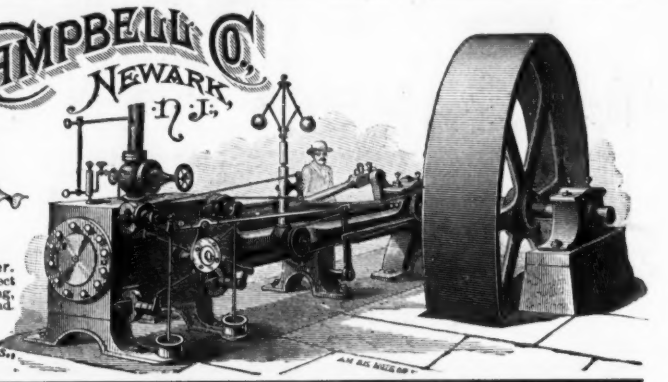

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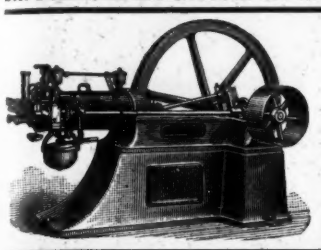

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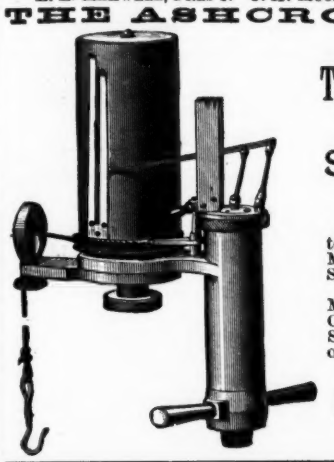

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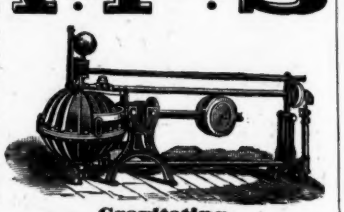

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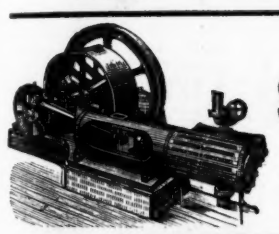

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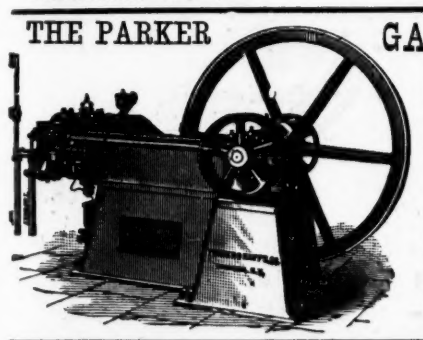

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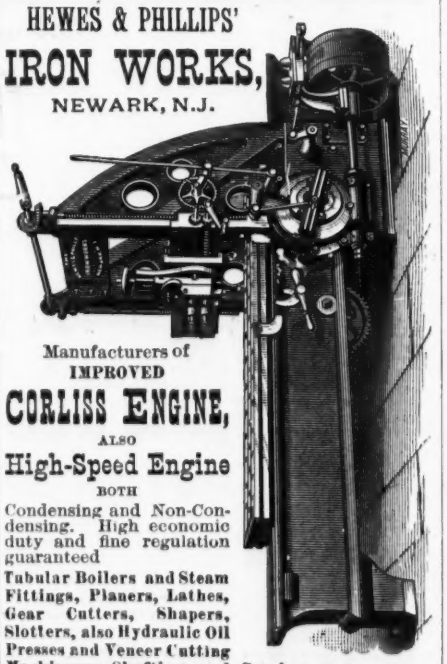

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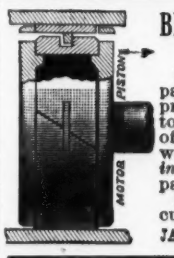

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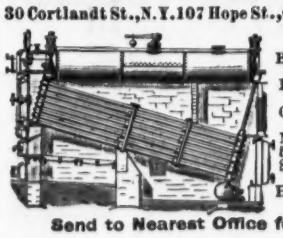

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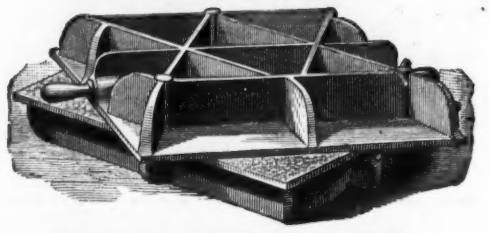

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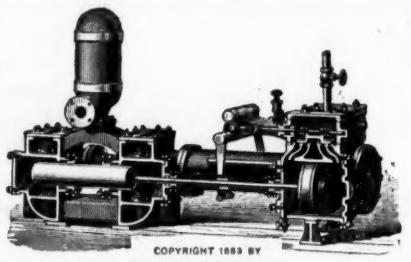

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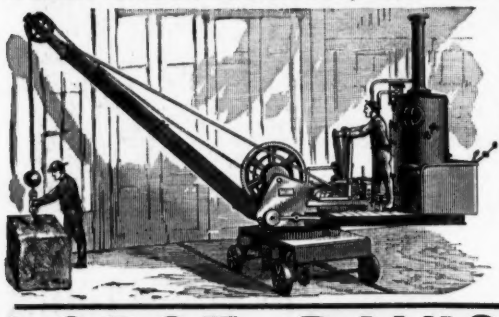

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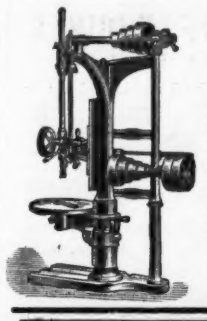

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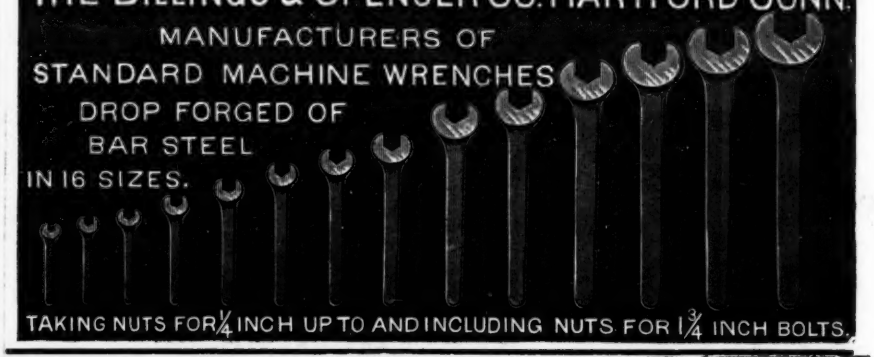

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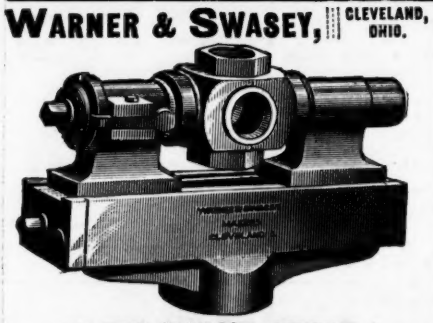

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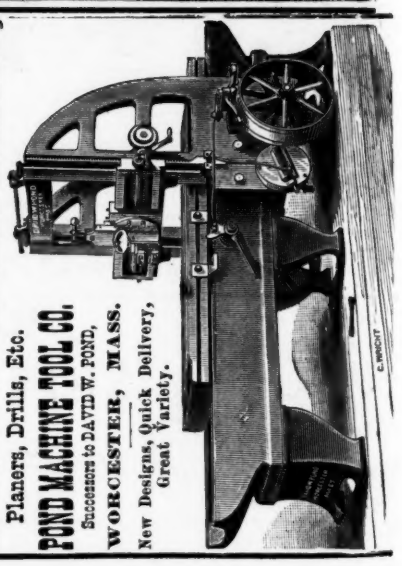

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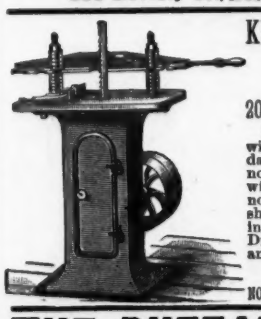

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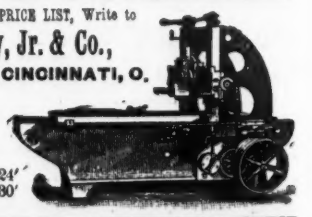

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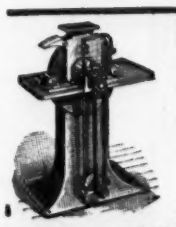

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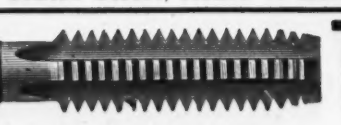

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